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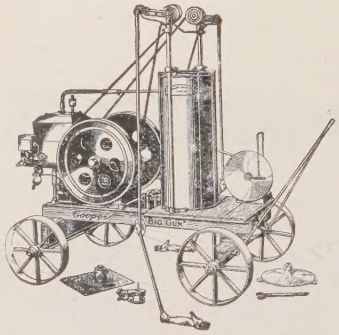

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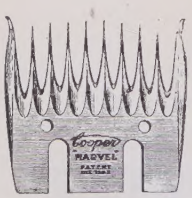

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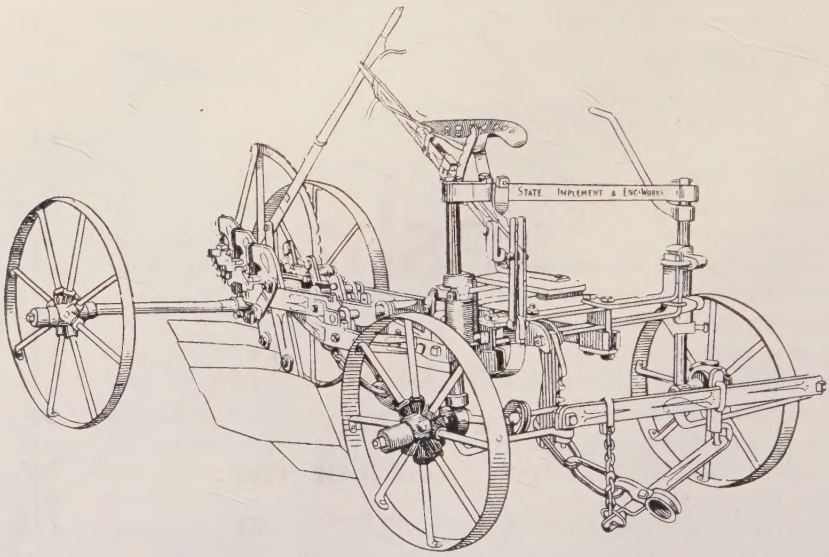

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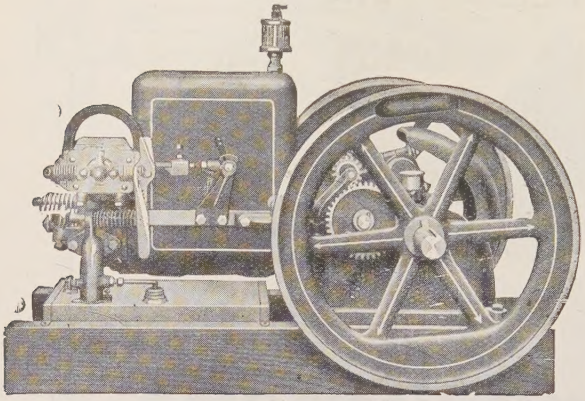

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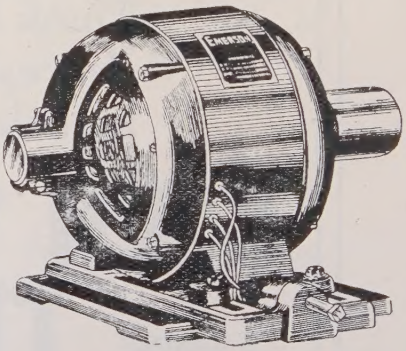

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OF THE

Department of Agriculture

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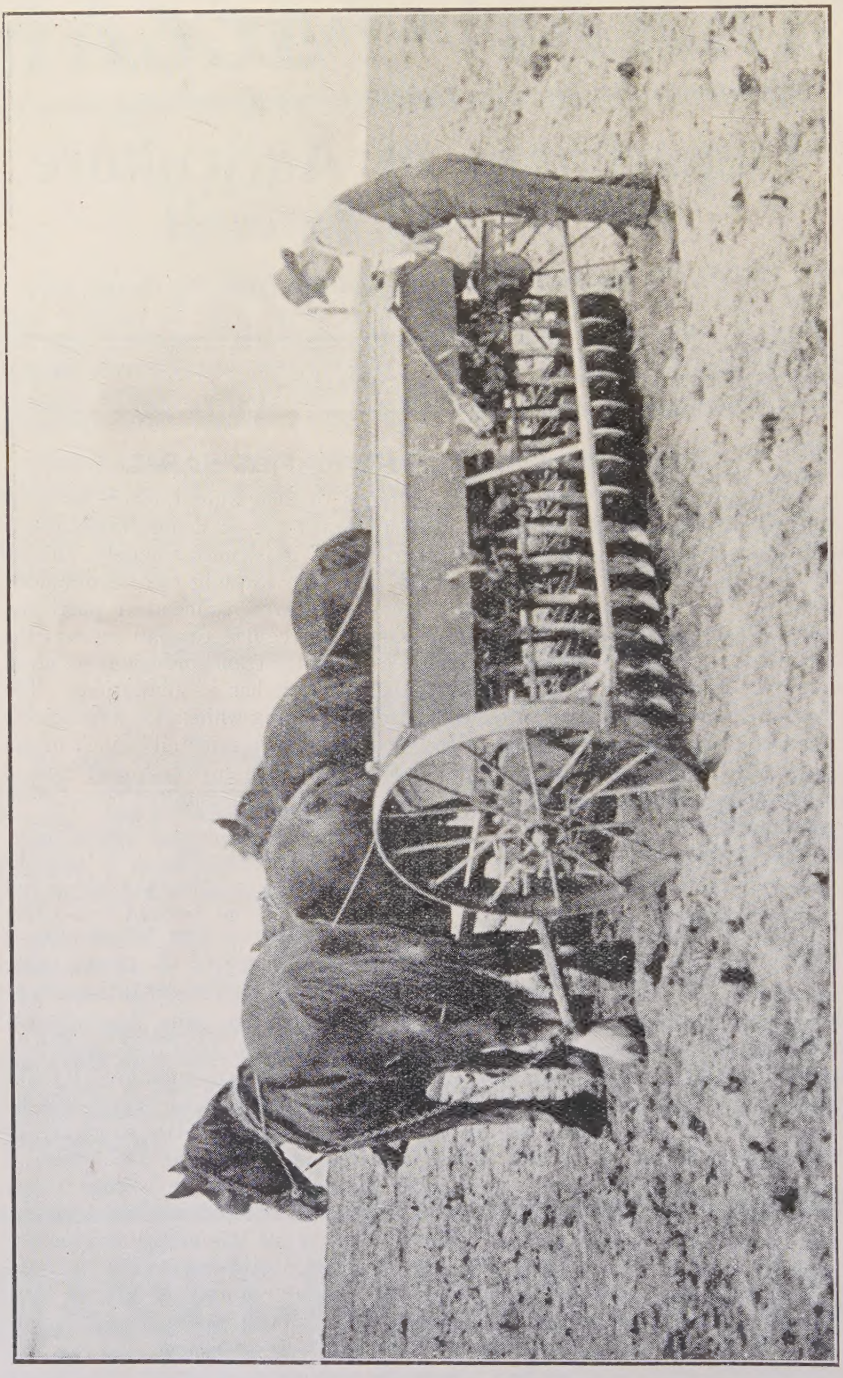
WONGAN HILLS LIGHT LANDS FARM.

The utilisation of our agricultural lands to their fullest extent is a desideratum that none will gainsay. That a quantity of good land is yet available for selection may be conceded, but most of it is, unfortunately, outside the zone in which it has been considered profitable farming can be pursued; some by reason of its great distance from the nearest railhead or port, and other because situated where an insufficient or irregular rainfall renders the result too speculative. Latter-day progress in motor transport has done much to remove the former disability, but as a remedy it has its limitations. The farmer cannot exact the full productivity of his holding while a too appreciable portion of his time is occupied in the business of a carrier and much of his capital tied up in the essentials for conveyance. The surest proved method of reducing transport expense to its minimum is by community effort, as represented by our railways.

Given large areas of first class land in a favourable climatic setting the provision of railway systems presents little difficulty, and the taxpayer is not unduly burdened by their upkeep. But railways cannot be said to operate successfully when carried through large areas of poorly populated and disused territory, and in this respect Western Australia is under a severe handicap, possessing more miles of railway per head of its population than any other State in the Commonwealth. Compared with other countries Australia, as a whole, shows to disadvantage from this viewpoint. In 1923 there were 4.65 miles of railway laid down to serve each 1,000 of our population. By like comparison Canada had 4.63 miles, while the Argentine, using figures for the year 1920, had only 2.51 miles, and the United States 2.41. But so great was the disparity of our own State that in 1923 we had no less than 13.72 miles of railway per capita thousand—three times as many lines as the average in any other part of the Commonwealth or Canada, five times that of the Argentine, and nearly six times that of the United States. While this makes an excellent showing from the viewpoint of facilities supplied, it also points the fact that our railways are sufficient to serve a much greater population than we have hitherto been able to attract, and, inversely, the taxpayer has to bear a proportionately greater expense. The remedy lies in closer settlement, and can best be effected by converting to use a far greater portion of our native soil. Nature has decreed that most of our alluviums should be what is termed "patchy." We have plenty of rich land; but interspersed with that of an inferior quality.



The Minister for Agriculture (Hon. M. F. Troy) starts the Machinery at Wongan Hills Light Lands Farm.

The scientific method, therefore, of creating populous centres out of our virgin bush involves the problem of absorbing erstwhile neglected areas into the wealth-producing realm. The Wongan Hills Light Lands Farm has been devised as a possible means of working to this end.

As far back as 1914 settlers in the Wongan Hills District had been exercising their minds over this problem. It is an earnest of their serious determination, as well as a tribute to their foresight, that the Wongan Hills Progress Association by making representations to the Minister for Agriculture,

Mr. Troy Addresses the Gathering.

succeeded in having reserved a site for a future experiment farm. But some events move slowly, and it was not until seven years later that a conference was convened by Mr. C. F. Baxter, the Minister for Agriculture at that time, which was attended by some 60 delegates and visitors from all parts of the State. Numerous papers were read, and in one submitted and read by the then Commissioner for the Wheat Belt, Mr. Geo. L. Sutton, he summed up his conclusions as follows:

> "Growing grazing crops and feeding them off is, therefore, fundamental to the maintenance or improvement of the fertility of the light lands. The successful solution of the problem of our light lands lies not, in my opinion, in the discovery of some new variety of wheat or the application of some special manure, but in the adoption of a farming practice which will give prominence to the growing of grazing crops, and their consumption on the ground by stock. The profitable utilisation of the light land is, therefore, intimately bound up with careful crop growing and skilful stock raising. Wheat growing will, therefore, occupy only a subsidiary part in cropping them instead of a major one as in the case of forest lands. This is especially the case on those light lands which do not possess a clay subsoil, for such lands are not firm enough for best results with wheat.

The light lands are cheap, large areas and fields are therefore possible; they are light to work and therefore large implements can be used, and they can be worked at all times, so that lost time can be avoided. All these factors tend to lower costs of operation to compensate for the lower yields than the forest lands, and help in the profitable utilisation of the light lands.

The Minister for Agriculture with the Moline Tractor.

The discussions following the reading of papers submitted disclosed a great diversity of opinion on the method of utilising these light lands. They were, as Mr. Sutton subsequently pointed out, "as varied and as many as the types of light land to be found in the State." But that conference achieved its object, for it was strong in affirming the principle of acquiring definite information on the potential resources of our light land areas. There was a general agreement on the following points: That drainage, fallowing, stock raising, early sowing of suitable varieties of wheat, the application of superphosphate, and inexpensive working methods implying big teams and large areas per man, were essential for the improvement of such areas of land. Their conclusions left three important points to be determined: How water logged lands could be cheaply drained; the most suitable varieties of wheat for such land; and, new varieties of suitable fodder crops for autumn sowing and possible catch crops for summer planting.

Following upon the deliberations of this conference the then Premier (Sir James Mitchell), when bringing down his Budget Speech, obtained approval of Parliament for the establishment of experiment farms on light land. After inspections of various localities had been made by the agricultural experts it was decided, subject to sufficient water supplies being available, to select the Wongan Hills site for the first of these experiments. Fortunately sufficient water for immediate requirements proved available, and in July, 1924, part of the site, comprising 6,683 acres, was dedicated to the Wongan Hills

Light Lands Farm. Under the supervision of Mr. I. Thomas, the Superintendent of Wheat Farms, the area was cleared and burned and prepared for cropping this season. Mr. Jas. Morley has since been appointed manager, and, using two units of motive power, one being an 8-horse team and the other a "Moline" tractor of equivalent strength, 700 acres have been cultivated and 400 acres planted. If at all possible it is hoped to crop 1,000 acres this year.

Such is the genesis of this first practical attempt under State supervision to cope with one of the most important factors conducive to the State's future prosperity. It is estimated that there are some nine million acres of light land in the present wheat belt, and assuming that the work of the light land farm accomplishes its objective and brings these into production within the next decade, what a vast increase in wealth, what a concomitant expansion of industry, population and prosperity may be looked forward to with a reasonable degree of certainty. It requires a good deal of optimism to anticipate such a glorious achievement, but it is not outside the world of possibility. Who can look back upon the wonderful accomplishments of science and human

Visitors' Vehicles Parked.

effort during the past quarter of a century and say this or that great hope is doomed to failure. Our American brothers are wont to talk in millions. It must be admitted that not only do they think and talk on gigantic scales, but what is more to the point, they "arrive." Are we less capable of realising our ambitions; less potent to will to success? Pluck, determination, and a blindness to failure are the great essentials to accomplishment, and who dare say that these qualities are lacking in "the legion that never was listed."

The benefits derived from other experiment farms in the State, and the influence they have had in increased production on the heavier lands, gives us every reason for faith in the Wongan Hills Light Lands Farm. Approval has been given for fencing the block on similar lines to those carried out at the Merredin State Farm, which has been found by experience both dog and rabbit proof. The present Government has manifested its bona fides in the

scheme, and it is more than probable that the Minister for Agriculture (Hon. M. F. Troy), whose picture we show setting in motion the machinery destined to prove this venture, is marking an epoch in the agricultural history of the

Interested Spectators.

State. The acquisition of such definite information as the Wongan Hills Light Lands Farm has been devised to procure is a necessity it would be foolish to ignore. It is gratifying to know that its application will be no longer delayed, and every step taken in the direction to which we are now committed will be watched by the many with eager expectancy.

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If you are not receiving the *Journal*, which is issued quarterly, and wish to do so, please forward your name and postal address to the Director of Agriculture, Perth.

TUBERCULOSIS IN DAIRY CATTLE.

F. Murray-Jones, B.V.Sc., M.R.C.V.S.,
Chief Inspector of Stock.

Tuberculosis is a disease of the greatest importance, not only from the fact of the economic losses to cattle owners, but also owing to its prevalence in the bovine species and the consequent serious bearing on the health of mankind through consumption of milk and meat. The world's authorities of to-day are agreed that the consumption of milk from tubercular cows is a grave

Fig. I.—A Typical "Lumpy" Animal.
A Tubercular subparotid lymph gland. B Tubercular submaxillary lymph gland.

menace to the health of mankind, particularly so in the cases of the very young and the aged.

The population of Perth and its adjacent suburbs are protected from one phase of this danger (*i.e.*, consumption of tubercular meat) by an efficient system of meat supervision. However, another aspect is the health of the animal responsible for the production of our milk supplies. This remark is not intended as an alarm note, but is made simply to direct the attention of dairy cattle owners to the need for greater vigilance, care, and attention in respect to any indication of tubercular trouble in individuals of their herds, and to suggest measures of co-operation with the officials at present responsible for their supervision, toward one end, namely the eradication of the disease. The Stock Department is seizing this opportunity of placing before those interested the real significance of this form of the malady, and at

the same time directing the attention of stock owners, by practical suggestions, to the best means of safeguarding their own, and at the same time others' interests in the detection and elimination of this disease in their herds.

The dairy cows of Western Australia may be divided geographically into metropolitan and country residents, but the percentage of tubercular animals in the one area must not be quoted as the index of the other: *e.g.*, because one hears occasionally of several animals in a metropolitan herd being tubercular, it certainly must not be taken to convey that this represents the

Fig. II.—A Typical "Waster" or "Piner."

state of every metropolitan herd, or can it in any way be made to represent the state of herds existing in the country. Experience and authority agree on this point; that the closer animals are herded together, especially under doubtful hygienic conditions, and the closer they live to mankind, the higher will be the percentage of disease. On the other hand, the wider animals graze, and the less frequent their contact with mankind, the smaller the number affected. The doctrine of tubercular emancipation is being preached by the authorities of the leading countries of the world. Even England, conservative as she has been in the past, has now fallen into line and has passed an Act known as the Tuberculosis Order. American cattle men are beginning to appreciate these forward movements, and have refused to admit any animals that have failed to pass the tuberculin test.

Cause of Tuberculosis.

The causative agent of this disease, the bacillus tuberculosis, was discovered by Koch in 1882. It is a slim, straight rod, measuring 2.5mm. to 3.5mm. long, and .3mm. to .5mm. thick. It grows on blood serum in from 10 to 14 days, but will not grow in ordinary agar or gelatine. There are three varieties of bacillus tuberculosis, *i.e.*, human, bovine, and avian. The bovine is shorter and thicker than the human; it is more virulent for cattle than the human: *e.g.*, inoculation of this form into cattle produces generalised

tubercular, but inoculation of the human only produces a local form. An important point is that outside the animal body the organism, if exposed to direct rays of sunlight, are soon killed. The dried expectorate from the cow

Fig. III.—A Suspicious Case.

containing the organism has been proved to remain virile for over 150 days. Sunlight, ventilation, and disinfection are the enemies of this organism.

Predisposing Causes.

Sufficient for the purpose of this article the predisposing causes may be summed up in two words—constitution and environment.

It is a recognised biological fact that the finer or higher the standard of the breed, the less resistant is the subject to an invasion of this character. Some breeds, like the Jersey, seem less resistant than others of a coarser type to the disease. The inference is not that Jerseys are in the ascendancy so far as percentage, but when subjected to condition of infection are less able to resist. As man has sought, by a system of selective breeding and domestication, to produce an animal on the lines of a milk machine, he has largely reduced that character of hardiness once possessed by the bovis under their natural condition.

Environment.—This plays a much larger part than that of so-called heredity. Cases of congenital infection are occasionally met with, but these are due to infection direct from the womb, or by portal blood stream. The retention of diseased animals in a herd has been found after a period of six to seven months to have infected their companions. Insanitary buildings, faulty drainage, filthy feed boxes, indifferent light, cowyards with several inches of dry manure upon which these animals recline, inhaling the dust and infecting the udder by way of the teats, are, in my opinion, the factors predisposing towards the disease.

Mode of Infection.

This occurs mainly by one of the three following channels: (1) Inhalation, (2) ingestion, (3) coition.

Inhalation.—In adult animals the most common mode of infection is by that of the lungs. This frequently occurs as the result of close contact with diseased animals. In old cows examined at the abattoirs and slaughter-houses

the lesions in the lung glands and lung tissue bear ample testimony to the path of infection. In this way one can easily understand how one diseased animal introduced to a herd can, in a comparatively short time, infect a number. Cattle do not expectorate in the way that human beings do, but

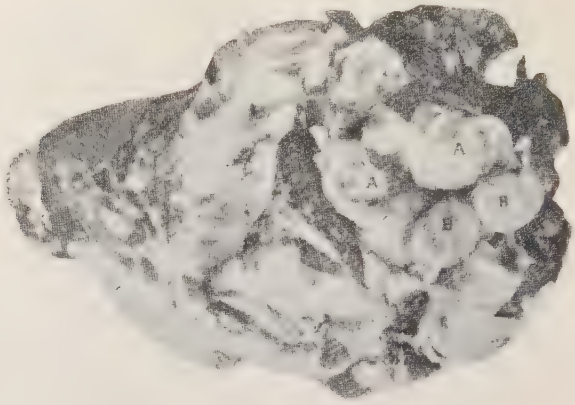

Fig. IV.—Tuberculosis in the Head.
AA Tubercular subparotid lymph glands.
BB Tubercular throat glands (retropharangeals).

as the result of the explosive effort induced in coughing a fine spray of moisture is discharged into the atmosphere in the form of small globules. These globules have been proved at times to contain the tubercle organism. These globules descend over herbage, fodder, fittings, as well as upon the companions of the diseased animal. Again, a percentage may dry, and in the form of fine dust be inhaled by other members of the herd. The chances of infection in this way can be easily understood when it is remembered how often we see three bails provided for 15 to 20 cows, and when it is the exception rather than the rule to observe any precaution being taken along the line of cleansing or disinfecting the bail and adjacent fittings.

Ingestion.—In old animals infection in this way is generally in the nature of a secondary infection. By this is meant that the animal has had the infection already in the lungs, and that during the progress of the expectorate from the lungs as it reaches the mouth it becomes swallowed, and so the organism is carried along the digestive tract with all the possibilities of infecting the stomach, bowels, etc.

In Victoria, prior to the introduction of the Dairy Supervision Act, it was found that a common cause of bowel infections in calves and pigs was feeding unsterilised separator milk that had been returned from the factory. This occurred in the following manner, *e.g.*: twenty farmers contributed milk to the factory. Unknowingly, one of them contributed milk from animals suffering from tuberculosis. At the factory the milk from the 20 was mixed. After the process of separating was completed the separator milk was run into a common receptacle, from which each man collected his share. What did this mean? It meant that infected milk left one farm but was distributed again to 19 others, and, being fed to calves and pigs, no doubt largely contributed to the percentage of the disease in these animals. A real menace to the health of the dairy cows of this State exists through allowing animals to feed from filthy boxes, often caked with dried discharges from earlier feeders whose health in this respect was perhaps of the most indifferent character.

Coition, or Sexual Contact.—Infection in adult animals may be spread by means of the bull during service. Occasionally one meets with a cow whose uterus on *post mortem* proves to be one mass of tubercular infection.

Fig. V.—Tuberculosis in Lungs.
AA Tubercular lymph glands (anterior mediastinals).

On inquiring the history of this animal, you learn perhaps from the owner that she could never be made to carry a calf, although a frequent visitor to the bull. You may also learn that she has been discharging, sometimes scantily, at other times freely. Bearing this in mind, it is an easy matter to imagine how a bull that has served such an animal could again in turn convey infection to other animals.

Congenital.—Cases have been noted of animals being born with evidences of the disease. This has been caused probably by the direct contact with an infected womb during the fœtal life.

Symptoms.

The disease is usually insidious in its development, and slow and chronic in its course. They may be in the acute or early stages, or the chronic or advanced form. In the inital stages the presence of tuberculosis may be overlooked, and not uncommonly well-marked and advanced lesions may be found in slaughtered animals that appeared perfectly healthy in life. As the pulmonary or lung form of the disease is most commonly met with, the symptoms, as might be expected, are chiefly in connection with the respiratory system.

In popular language the following terms are used by cattle men to indicate certain classes of animals showing certain deviations from the normal: (1) The waster or piner; (2) the lumpy; (3) the cougher; (4) the roarer or snorer.

The Waster or Piner is an animal that may be suffering from the disease without showing any definite symptoms. It is usually unthrifty, remaining poor in spite of good feeding, tucked-up in appearance, arched in back, head carried forward, eyes sunken, face muscles shrunken, coat rough and staring, legs "proppy"; altogether a miserable and dejected animal. (See Fig. II.) Being moved quickly may give rise to a short, dry, intermittent cough, easily induced, especially early in the mornings if the weather be cold. This type of animal should be regarded with the greatest suspicion.

The Lumpy (see Fig. I.).—This term is meant to convey that the animal is suffering from a form of glandular tuberculosis, involving the "kernels" or lymph glands of the head or some other part of the body. The most common region is that of the head, frequently the parotid gland below the ear, or submaxillary below and on the inside of the angle of the jaw, or the retropharangeal gland situated at the base of the tongue. When the latter are enlarged they may be distinctly felt filling the space between the lower jaws. Often the term is used to indicate an enlargement on the jawbone itself, which is frequently of an actinomycotic character. Again, these lumps may be seen in other regions of the body in the position of the lymphatic glands, *e.g.*, (1) along lower part of neck, cervical glands; (2) at point of shoulder, prescapular glands; (3) in flank, precrural glands. One of the most important situations of this lumpy condition is the mammary gland, or udder.

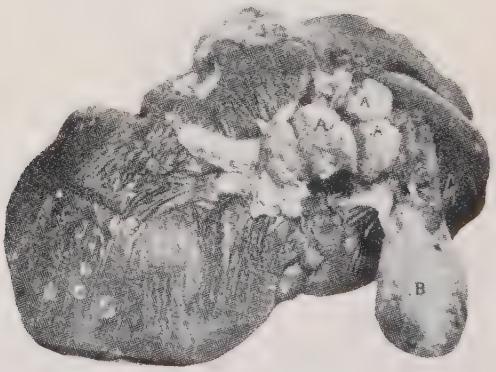

Fig. VI.—Tubercular Invasion of Liver.
AA Tubercular glands (hepatic-portals). B Gall bladder.
C Tubercle distributed throughout liver.

This gland is situated high up at the back of the organ, and the best method of detecting it is to examine the "bag" after milking. The person examining should stand at the side of the hind limb, one hand resting on the rump, and the free hand to be used in carefully manipulating the udder at the "back show" in the centre line high up. Should this gland appear enlarged and hard, somewhat resembling a walnut or golf ball, immediate steps should be taken to have the animal examined by a competent person. If neglected this may extend to other quarters of the organ, with serious effects on the milk, which may become infected with the tubercle organism. The term

"lump" is often used to describe the swelling caused by a grass seed abscess in the region of the throat. A rough guide is as follows: In the case of a grass seed abscess there is heat, pain, and a tendency to point or suppurate. After breaking, the skin at that spot is found considerably thickened. The more serious lumps are usually hard, "cold," and, in the case of tuberculosis, not inclined to suppurate. But in cases of actinomycosis there may be a suppurative discharge.

The Cougher.—By this term we refer to an animal whose cough is frequent, and may be short and dry or prolonged and moist in character. This is generally an advanced case, and there is usually a loss of condition. Nevertheless, we frequently meet with animals which, in spite of these symptoms, maintain condition, and yet on subsequent slaughter present extensive lesion. The appetite may be slightly impaired. Usually there is not any nasal discharge, and any expectorate is generally swallowed when it reaches the pharynx (gullet). The significance of this swallowing is that the expectorate generally contains the tubercle bacilli, and so secondary infection of bowels may take place. As this form of the disease progresses the animal becomes more emaciated, the eyes become sunken, followed by anæmia and general debility.

The Snorer or Roarer.—This symptom generally follows as the result of the glands at the base of the tongue (retropharangeals) becoming involved, and a distinct snoring sound is produced in moving the animal. When the larynx or voice box is affected by the formation of this tubercular tumor a distinct roaring sound follows.

The Owner's Responsibility.

It must be carefully borne in mind that it matters not where the lumpy conditions may exist, they must always be regarded with the gravest suspicion, and in compliance with regulations under the Stock Diseases Act are to be treated as notifiable diseases. *Immediate notification to the local stock inspector or to the Stock Department is necessary.*

The Tuberculin Test.

This test is used for the purposes of diagnosis. The principle of the method consists in the thermal or temperature reaction which follows the introduction of a quantity of specially prepared glycerine extract of pure cultivation of tubercle bacilli. The test requires skill and knowledge in its use. In the hands of the untrained or inexperienced the results are misleading and absolutely unreliable.

Preventive Measures.

Hygiene.—In discussing this aspect as bearing a most important part in the spread or eradication of this disease, one cannot emphasise too strongly the necessity for a higher standard of hygienic conditions than at present exists as regards buildings, drainage, disinfection, light, and ventilation of places used for accommodation of dairy animals.

Buildings.—Many of the present day cowsheds were constructed probably from 30 to 40 years ago, without any pretence whatsoever to hygienic principles. In many cases sheds accommodating from 20 to 25 cows possess roofs so low that a man of average height must stoop to enter; the stall

accommodation so inadequate that it is almost an impossibility for a person to walk in and release the bail pin in order to liberate the cow; the floors are ill-drained, and the fittings corroded with the dust of ages.

Fig. VII.—A Case Condemned for Generalised Tuberculosis.
Note: Lungs and Liver suspended to Carcase with Hooks.

Drainage and Disinfection.—These are phases that should receive the closest attention. In many obsolete sheds the floors are pervious, allowing absorption of the escaped body fluids. One effect of this is the pollution of the atmosphere breathed by the animals during detention, and another that accommodation is provided for disease organisms. A good, cheap, and effective disinfectant is the application of common lime, or the chloride of lime. The best way to use this is in the form of milk-lime, distributed with a spray pump. By this means it is an easy matter to disinfect floors, walls, and fittings.

Light.—All authorities agree that the influence of daylight has a beneficial effect on the health of the individual, whether that individual be human or animal. Sunlight has in a very short time a most destructive effect on the tubercle bacilli. There should not be any corner of a cowshed to which sunlight is unable to gain access.

Ventilation.—By this we do not mean draught, but simply the establishment of currents of pure air throughout a building by the provision of apertures provided at certain points; these being directed in such a manner as not to bear directly upon the animal within. A cowshed being open one way does not provide everything necessary. There must be a free circulation of pure air. How often does one find a cowshed cleanly in many ways but with a close and stuffy atmosphere, and the place black with flies, the latter often dropping into the milk cans waiting to receive the milk when drawn. On asking one owner why he did not have better ventilation, which would not only have sweetened the air but also dispersed the flies, he informed me "that it remained so for the comfort of the milkers during the winter." This man was evidently quite oblivious to the real object of good ventilation.

In urging that efforts should be directed along the lines indicated by providing conditions that will make for an improvement in the general health of the dairy cow, and so ensuring a higher degree of resistance to this dreaded disease, one cannot overlook the good work that has been done in Victoria in this direction. On the introduction of the Dairy Act in 1906, dairymen in Victoria were strongly opposed to what they called new-fangled ideas, but what do they say to-day? The men whose opinions are worth the having are more than satisfied with the results. The latest statistics quoted by the Director of Agriculture (Dr. Cameron) and the Chief Veterinarian of Victoria show that in the districts where the Dairy Act is in force the percentage of tubercular cases are considerably lower than before, this being largely due to the improved conditions under which the dairy animals are being kept.

FEED IN RELATION TO BUTTER-FAT TESTS.

"Many farmers have endeavoured, without or with little success, to raise the test by the use of certain kinds of feed," writes W. N. Paton in the *New Zealand Journal of Agriculture*. It can be safely stated that there is no feed which will of itself appreciably raise the test. By the use of certain feeds it is possible to raise the test by small amounts, but such increases are usually only temporary. Provided a cow is well fed, and receives a good variety of palatable food which supplies the essentials, she will return as much butter-fat by this means as by any other, and with less trouble to the feeder.

PHOSPHATIC FERTILISERS AS MANURES FOR GRASS LANDS.

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The various commercial fertilisers contain their phosphoric acid in several forms of chemical combination, as follows:—

(1) Tri-calcic phosphate.
(2) Mono-calcic phosphate.
(3) Di-calcic phosphate.
(4) Tetra-calcic phosphate.

(1) Tri-calcic phosphate ($Ca_3P_2O_8$), which is always considered agriculturally as consisting of three parts of lime (CaO) and one part phosphoric acid (P_2O_5), can be represented diagrammatically as—

Lime]
Lime } Phosphoric acid.
Lime]

The term tri-calcic phosphate is not chemically strictly correct, as in addition to the three parts of lime and one of phosphoric acid there are generally small amounts of one or more elements present in combination.

This form of phosphate is found in bones and other animal remains, such as guano, which have not been treated with a strong acid. It is so very slightly soluble that it may be described as insoluble in water. In soil water, which contains carbon di-oxide in solution, and is therefore weakly acid, tri-calcic phosphate is slightly soluble. The extent of its solubility varies—

(a) With the material, bones being more soluble than the rock phosphates, and these again vary in their solubility, some of the softer ones being almost as readily available as bones, while others are very resistant to weak acids.

(b) With the fineness of grinding—the finer any material is ground, the more readily is it acted on by the solvent. Fine salt dissolves more readily than coarse, and this, again, quicker than rock-salt.

(2) Mono-calcic phosphate: this is not found naturally, and is prepared by treating tri-calcic phosphate with an acid, sulphuric acid being always used in practice, two parts of lime going into combination with the acid and two parts of water joining up with one part of lime and one of phosphoric acid when the acid and tri-calcic phosphate are mixed together in the correct proportions. The reaction may be represented diagrammatically thus:—

$$\left.\begin{matrix} CaO \\ CaO\ P_2O_5 \\ CaO \end{matrix}\right\} \text{ and } \left\{\begin{matrix} H_2O,\ SO_3 \\ H_2O,\ SO_3 \end{matrix}\right.$$

gives—

$$\left.\begin{matrix} CaO \\ H_2O,\ P_2O_5 \\ H_2O \end{matrix}\right\} \text{ and } \left\{\begin{matrix} CaO,\ SO_3 \\ CaO,\ SO_3 \end{matrix}\right.$$

or—

$$\left.\begin{matrix} \text{Mono-calcic} \\ \text{phosphate} \\ Ca\ H_4\ P_2\ O_8 \end{matrix}\right\} \text{ and } \left\{\begin{matrix} \text{Calcium sulphate} \\ \text{(or Gypsum)} \\ 2Ca\ S\ O_4 \end{matrix}\right.$$

That is to say, that when tri-calcium phosphate of lime and sulphuric acid are brought together in the correct proportions a chemical reaction takes place which results in the formation of a phosphate of lime which is soluble in water, and gypsum or sulphate of lime is also formed.

(3) Di-calcic phosphate: this compound is formed when phosphoric acid or mono-calcic phosphate is treated with lime or lime water. It is only slightly soluble in water, but is easily soluble in weak acid, and in water its solubility is greatly increased by the presence of many neutral salts, *e.g.*, ammonium citrate. It is more readily available as plant food than is tri-calcium phosphate. Di-calcium phosphate is found in basic superphosphate, most of the phosphoric acid in this manure being in this form. There is generally about one per cent. in superphosphate, when it is described as citrate soluble or reverted phosphate. It is also formed in the soil when the dissolved water-soluble phosphate, in superphosphate, comes in contact with carbonate of lime.

(4) Tetra-calcic phosphate ($Ca_4P_2O_9$), or a compound of four parts of lime with one part of phosphoric acid. It was at one time considered that this was the form in which phosphoric acid was found in basic slag; more recent opinion tends to the view that the bulk of the phosphoric acid in slag is present as a complex lime, iron, silica, phosphate; the true tetra-calcic phosphate being less soluble than slag phosphate.

Iron and aluminium phosphates are not important to the farmer as constituents of manures, as they are seldom found in commercial fertilisers. They are very insoluble in water, and are not dissolved to an appreciable extent in weak vegetable acids. They are of importance in manuring, however, as in soils deficient in lime or containing an excess of iron there is a danger that phosphoric acid applied to the soil may combine with the iron to form an iron phosphate, and thus, though not lost to the soil, will be present in such an insoluble condition that plants will be unable to make use of it. The more soluble the form of phosphoric acid when applied to the soil, the more quickly will it go into combination with substances present in the soil.

If lime is present, a di-calcic phosphate will be formed which will no longer be soluble in the usual sense, but will be available to plants; if lime is deficient or iron is in excess there is a danger that the iron phosphate will be formed. It is probable that the rapid formation of an iron phosphate accounts for many cases where a heavy application of phosphatic manure gives only a small return after the first season, although the first season's crop can have removed only a fraction of the P_2O_5 applied.

The following are the most important of the phosphatic fertilisers at present used in Western Australia, excluding compound manures made up for use on special crops:—

(1) Superphosphate: Large amounts of this are used annually in this State. Its use in the wheat belt has made possible the utilisation of land which, without it, would not pay for cultivation, and with it, give handsome returns. In the wetter areas it has been used for many years on the cultivated crops, but only to a limited extent, as a manure for grass land in the form of top-dressing. Its use for this purpose is now extending rapidly, and is likely to increase even more rapidly in the near future.

The whole of our supplies are manufactured in the State from phosphatic rock imported from Christmas and Nauru Islands, where there are millions of tons of this substance formed from the leached deposits of now extinct sea-birds.

The rock is pulverised by grinding and then treated with sulphuric acid, when the reaction occurs as explained on page 172. After a thorough mixing the mixture falls into the "den," where it dries, partly from the heat of the chemical action and partly from the anhydrous calcium sulphate taking

up two molecules of water to form gypsum. After drying the "super" is removed from the den by mechanical means, reground, and bagged ready for transport to the farm.

The sulphuric acid used is also made at the fertiliser works, and is prepared from Sicilian or American sulphur.

The superphosphate is sold with a guaranteed analysis, which is at present very high, viz. 22 per cent. total phosphoric acid, of which over 20 per cent. is water-soluble. Over half the weight of superphosphate is gypsum, which is not charged for, but which is of value on some soils, it having been found to give an increased crop in several cases when used as a manure.

In local experiments the increase was not sufficiently great to justify its purchase and use alone. It is, however, probable that its presence in super accounts for this manure giving better results than some other forms of phosphatic manure in areas of heavy rainfall, where it would be anticipated that a less soluble manure would give equally good results.

(2) Basic superhosphate: This is a mixture of 85 parts of super with 15 parts of air-slaked lime. After thoroughly mixing the mixture is allowed to stand 24 hours before sowing or re-bagging. By this treatment the phosphoric acid of the super is converted into di-calcium phosphate, which, although no longer soluble in water, is practically as available to the plant.

Basic phosphate should not be mixed with sulphate of ammonia.

(3) Double Acid Phosphate is seldom, if ever, quoted here, though occasionally inquiries are made concerning it. It is usually prepared from mineral phosphates of too low a grade to be used in the manufacture of ordinary superphosphate. The phosphate is treated with sufficient dilute sulphuric acid to combine with all the calcium, setting free the phosphoric acid; the muddy solution is allowed to settle, and the clear liquid, which is weak phosphoric acid, is concentrated and used to treat a further quantity of phosphate. The product is chiefly water-soluble phosphate. This manure is of economic importance only in places where freight and cartage are excessively high, circumstances in which the manuring of grass would not be profitable.

(4) Thomas' Phosphate or Basic Slag is a by-product of the steel industry: all the earlier slags on the market were from steel from the "Basic Bessemer" process invented by Thomas and Gilchrist (1878-79). By the introduction of lime into the molten metal the phosphorus, which, if retained, renders iron brittle in the cold, combines with the lime and is got rid of in the slag. The slag, if sufficiently rich in phosphoric acid, is first broken up into small pieces and then ground into a fine powder. Fineness of grinding is most important, and because of this 80 per cent. of "Basic Slag" should pass through a sieve containing 10,000 holes to the square inch.

The Bessemer process is now being largely superseded by the Siemens or open hearth process, which gives a slag usually with a smaller percentage of phosphoric acid than the Bessemer process. As the temperature of these open hearth furnaces is usually lower than the Bessemer converter, a certain amount of fluor spar (calcium fluoride) is added to make the slag flow more readily. The addition of the fluor spar has the effect of making the phosphoric acid of the slag less soluble in weak acids, and therefore presumably less soluble in the soil. This fluorspar slag is worth less to the farmer than the older type of slag, and though probably of value on grass lands when close to the source of supply, in any case superphosphate or the higher grade slags will prove more economical in use.

It is often stated that basic slag contains a large percentage of lime, various analyses giving percentages of lime (CaO) varying from 38 per cent. to 52 per cent. It must be remembered that only about 2 per cent. is present as free lime, the balance being present in combination with phosphoric acid and silica. The silica breaks down in the soil, and the lime which is set free is then of use. Three factors should be considered when purchasing basic slag:—

(1) Percentage of phosphoric acid. Usually the higher the percentage the better the slag.

(2) Fineness of grinding: this is very important, as unless finely ground the slag will have a very low availability.

(3) Solubility is not so important as (1) and (2), it having been found in experiments at Cockle Park that slags of medium solubility gave the best results.

Generally speaking, basic slag has not given as good results as superphosphate on the pastures of this State; therefore, unless the country has been proved for some particular soil, it will be best for the farmer to use super as a fertiliser for his grass land.

(5) Bonedust: Bones were the first phosphatic manure to be used on grass land. We first read of them as having been used in Yorkshire; then in the early years of the nineteenth century they were used in Cheshire to renovate exhausted dairy farms.

At first the bones were broken like road metal, in which condition their action was very slow, but extended over a long period. In 1829, Henderson of Dundee built a machine for making half-inch bones and bonedust. Bones contain about 20 per cent. phosphoric acid and 3.5 per cent. nitrogen. Some of the bonedusts on the market contain a higher percentage of nitrogen than this, as a large amount of organic matter is incorporated. Other samples, again, are very low in nitrogen, the bones from which they are prepared having been weathered for long periods.

Bonedust is so highly valued for horticultural purposes that it can but seldom be bought at a price low enough to make it a payable proposition on grass land.

(6) Dissolved Bones were first prepared by Liebig in 1840 by treating crushed bones with sulphuric acid, the tri-calcic phosphate of the bones being converted into a water-soluble phosphate in the same way that the tri-calcic phosphate of rock phosphate is converted into mono-calcic phosphate in the manufacture of superphosphate. In 1842, Lawes and Gilbert adapted this method to the treatment of mineral phosphates, and so founded the superphosphate industry.

In addition to the phosphoric acid, which is in the same state chemically as that in super, dissolved bones also contain some organic nitrogen. In practice it gives little if any better results than a mixture of super and sulphate of ammonia of the same analysis, and as this mixture can be obtained more cheaply it should be used when a manure containing some nitrogen is desired. In some cases, when first sowing down land to grass, a manure containing some nitrogen is desirable to give the young plant a good start. Even for clover, if the soil is not naturally rich in nitrogen, some nitrogen in the manure is desirable. Once the clover is established, further applications of nitrogen should not be necessary.

(7) Rock Phosphate: The mineral or rock phosphates vary greatly in their composition and solubility, varying with the circumstances under which they have been laid down and the age of the deposits. When finely ground

and applied in a heavy dressing (10 cwts. or more per acre) some of the softer phosphates have given good results on permanent grass in England. In small amount, by themselves, they are unlikely to be suitable to our conditions, though a mixture of ground rock phosphate and superphosphate may prove of value on ironstone or open sandy soils where a neutral manure is indicated.

(8) Bone Ash is not on the market, but is a useful way of using bones when no means of grinding them are available, or if the bones are suspected of being diseased. Bones burn readily, and after burning are easily broken up into a fine powder for distribution. No phosphoric acid is lost in the process of burning as it is not volatile, but unfortunately all the nitrogen is driven off; however, the bone ash is more valuable as a fertiliser than whole bones, and the loss of the nitrogen must be put up with, failing machinery to grind the bones. Bone ash contains about 37 per cent. phosphoric acid (P_2O_5), which is probably in a much more available form than the phosphoric acid in rock phosphate.

With the exception of ground rock phosphate, which is not suitable for general applications, of the above fertilisers superphosphate supplies phosphoric acid at the cheapest rate per unit. It has proved a suitable source over a very wide range of soils in the South-West, and it is therefore economic practice to use it unless there is experimental or other evidence indicating that it is not as suitable as other forms. In basic slag and basic superphosphate (not basic phosphate) the cost per unit of phosphoric acid is about the same, and the top-dressing experiments on the Abba River Groups indicate that similar results are obtained from either.

(*To be continued.*)

VALE J. S. OGILVIE.

Readers of the *Journal of the Department of Agriculture* will regret to learn of the decease of the late Editor, Mr. J. S. Ogilvie, who passed away in St. John of God's Hospital, Subiaco, after an illness of some four months' duration. Mr. Ogilvie was a man of broad sympathy and wide experience who had seen much of the world, besides being of a retiring disposition. He made many friends both inside and outside the Civil Service.

Born about 1862 in Arbroath, Scotland, he was educated at the Edinburgh University, and spent a considerable period of his life in travel before settling down in this State. For a time he occupied a position as school teacher in the North-West, subsequently accepting a position as Publicity Officer with the Forests Department, which work he carried on for a period of four years. When the Council of Industrial Development was formed Mr. Ogilvie was transferred to that Branch of the Service, again in the capacity of Publicity Officer, and latterly as Acting Secretary, which position he occupied at the time of his demise. Mr. Ogilvie contributed to several newspapers, including the *West Australian*, and for the past nine months was associated with this *Journal* as Editor. He leaves a widow, son and daughter to mourn their loss, to whom we extend sincere and heartfelt sympathy. His geniality and kindliness will long be missed by his large circle of friends.

The late J. S. Ogilvie.

A REPORT ON FOUR YEARS EXPERIMENTAL CULTIVATION OF PEPPERMINT IN WESTERN AUSTRALIA.

H. V. MARR.

At the latter end of the year 1920, Plaimar, Limited, imported into Western Australia a quantity of Mitcham Peppermint Roots (*Mentha piperita officinalis*), Black Mint, with the object of testing the quality and quantity of the oil produced in order to ascertain whether the industry would justify development commercially. It has been stated at various times that when Peppermint is transplanted to districts outside its particular home in England, the chemical and physical properties of the essential oil undergo change; also that the most important property, that of the aroma, is subject to alteration. It is further stated that no Peppermint oil produced elsewhere in the world can equal the particular bouquet obtained from Peppermint oil grown in England.

The following brief report gives the result of several years' cultivation in Western Australia, and a comparison of the various analyses submitted, which have been taken over a fairly lengthy period, will indicate that the quality of the oil has shown comparatively little variation; in fact it may be said that from an analytical standpoint the constants of true Mitcham Peppermint oil have been well maintained.

It will be noted, however, that as experiments proceeded, an important constituent represented by the menthol content of the oils became higher than that generally found in Mitcham Peppermint oil, and considerably higher than that usually present in highest-grade American Peppermint oils.

The seasons in Australia are, of course, the reverse to those in England. The planting of the mint should take place in the early spring, and may be commenced at the latter end of July and proceed through to the beginning of October. The mint is ready for harvesting at the end of February, or the beginning of March.

The following are the results of the examination of various samples of Peppermint oil obtained, and in every instance the analyses have been conducted on the unrectified oil.

Year 1920-21.—The roots entered the State in December, 1920, and were planted immediately and allowed to grow until the following March, when the herbage was cut and a small quantity of oil obtained therefrom. This oil was of excellent aroma, but was of insufficient dimensions to conduct an analysis upon.

Year 1921-22.—The crop obtained this year was the product of the previous year's importation of roots, and sufficient oil was obtained to make an exhaustive analysis and test its quality. Small samples sent to London were pronounced to be of excellent quality. The herb from which the oil was obtained was cut and distilled in February, 1922, and had the following analysis:—

Specific gravity at 20° C.—0.907
Optical rotation— −27° 42′
Refractive index at 20° C.—1.461
Free menthol—52.9 per cent.
Combined menthol—6.4 per cent.
Total menthol—59.3 per cent.
The estimation of menthone in this oil was not carried out.

Year 1922-23.—In this year the roots were planted at Yarloop on reclaimed swamp ground; this district being about 80 miles from Perth. About one acre of mint was planted about the middle of September, 1922. The herb was cut and distilled at the beginning of March, 1923, and was found on analysis to have the following characteristics:—

Specific gravity at 20° C.—0.910
Optical rotation— – 20° 42′
Refractive index at 20° C.—1.4570
Free menthol—58.7 per cent.
Combined menthol—6.7 per cent.
Total menthol—65.4 per cent.
Menthone—13.21 per cent.
Solubility in 70 per cent. alcohol—1 in 2.5 vols.

Samples of the oil distilled during this season were sent to London in the early part of 1923, and were favourably commented upon by experts, particular mention being made of the high menthol content of the samples.

Year 1923-24.—An area of about 25 acres in the same district as the previous years' experiments was put in, but owing to bad cultivation and continued recurrence of rain, causing floods, right through until the beginning of December, the planting was a failure. The results being so discouraging it was decided to omit distilling this season, as it was not considered the product would be a true guide. Late planting gave the mint a serious setback from which it was impossible for it to recover that season.

Year, 1924-25.—This year's experiments were carried out in the Byford district nearer to Perth, being situated about 28 miles distant, on soil varying from dark loamy to a rich chocolate, light in texture. Sufficient roots were brought from Yarloop to plant about 3½ acres of ground, and planting was commenced in the middle of September, and continued until the second week in November.

The mint made rapid headway in this locality, and seemed to thrive much better in the richer soil in which it was planted. The soil in the Yarloop area being swamp ground, was sour, and owing to repeated flooding in the winter time, planting could not be done until too late in the season to insure good results. At Byford, although ample water is available for irrigation purposes, a perfect system of drainage can be maintained, thereby removing any chance of the mint rotting due to the presence of too much moisture.

In the Byford district the only fertilisers used were a mixture of potassium and ammonium sulphates. A portion of the crop was cut and distilled in the middle of February, 1925. The resulting oil proved to be of fine aroma, equal to and probably better than that of previous years' experiments. This sample had the following analysis:—

Specific gravity at 20° C.—0.905
Optical rotation— – 29° 11′
Refractive index at 20° C.—1.4635
Free menthol—62.24 per cent.
Combined menthol—6.1 per cent.
Total menthol—68.34 per cent.
Menthone—not estimated
Solubility in 70 per cent. alcohol—1 in 2.5 vols..

The balance of the crop was cut a fortnight later and distilled, same having commenced to blossom. Analysis of the oil obtained from the balance of the crop gave the following figures:—

Specific gravity at 20° C.—0.909
Optical rotation— – 25° 29′
Refractive index at 20° C.—1.4610
Free menthol—54.36 per cent.
Combined menthol—11.8 per cent.
Total menthol—66.16 per cent.
Menthone—9.46 per cent.
Solubility in 70 per cent. alcohol—1 in 2.8 vols.

Simultaneously with the planting of the crop at Byford in the year 1924-25, a quantity of the roots were also sent to the Mount Barker district, near Albany. The herb from this small plot was cut and distilled about three weeks later than the main crop obtained from the Byford experimental area. The Peppermint oil from the Mount Barker district gave a striking figure for total menthol, containing as it did 75.5 per cent., being over nine per cent. higher than any previous experiments conducted in West Australia by Plaimar, Limited. The oil was of fragrant aroma, but smelt somewhat more strongly of menthol than other samples produced. The following is the analysis—

Specific gravity at 20° C.—0.908
Optical rotation— – 31° 53′
Refractive index at 20° C.—1.4604
Free menthol—58.65 per cent.
Combined menthol—16.85 per cent.
Total menthol—75.5 per cent.
Menthone—not estimated.
Solubility in 70 per cent. alcohol—1 in 2.7 vols.

During the year 1925-26 Plaimar, Limited, expect to have planted 30 acres of Peppermint, and it is fully anticipated that the high quality of the oil obtained so consistently throughout the past years, will be well maintained.

Plairmar, Limited, are requesting the editor of the *Perfumery and Essential Oil Record* to publish the above details and to supplement the report with an expert opinion on the aroma and flavouring properties of the samples forwarded.

Some idea of the close proximity with which the locally-produced Peppermint oil corresponds with what is popularly termed "English Mitcham Peppermint Oil" may be gauged from the following limits of analysis within which English Mitcham Peppermint Oil is found to occur:—

Specific gravity at 15° C.—0.902 to 0.910
Optical rotation— – 20° to – 33°
Refractive index—1.460 to 1.463
Total menthol—58 per cent. to 65 per cent.
Menthyl acetate—6 per cent. to 14 per cent.
Menthone—8 per cent. to 14 per cent.

Quite independant of chemical analysis, however, is the important question of aroma, which property can only be decided by expert opinion, and in this connection the local oil has been favourably commented upon.

SHEEP ON THE WHEAT FARM AND THEIR MANAGEMENT IN WESTERN AUSTRALIA.

Hugh McCallum,
Sheep and Wool Inspector.

The farmer is daily finding out the value of sheep on the wheat farm. The man on the land now realises that no farm is complete without sheep, under present day conditions. They are a necessity to enable him to obtain the highest possible return for his wheat or hay. The sheep enrich the land. They also keep same clean, as they will eat off all pastures prior to cultivation, which enables the crop not to be over-run with various grasses and weeds that come up with the crops should there be no sheep kept. Therefore, they take a definite part in the production of crops.

Where sheep are not pastured on the farm, grasses and weeds grow up with the crops, and absorb a certain amount of nourishment that otherwise would be available for the crops. From such unclean land the farmer cannot expect the returns to be as large as from clean land. Where sheep are kept stubble need not be destroyed, as the sheep can feed on it. This can also be stacked as a reserve of feed should there be a dry year. The grower who has a stock of stubble can always command a big price for same when feed is scarce. Reserves in feed of any kind, either in hay, stubble, straw, or chaff, are a necessity on a farm. Just as bankers or manufacturers must have reserves to conduct their businesses satisfactorily, so must the farmer have plenty of feed and water to see him through a dry season. It will not then be necessary for him to place his stock on perhaps a falling market.

Contrast the difference of the farmer who prepares for a dry summer to the man who, by not looking ahead, has had to place his stock on the market at a time when there is a glut. He has either to sell or see his stock die. The producers are conducting a business that requires every possible attention to make it successful; and to the man who conducts farming on business principles prosperity is assured. Should the crops be a failure from any unforeseen circumstances (wheat failures do occur) and sheep are not kept, there is no income. But if sheep are pastured there is a return from wool and mutton. It is certain that for many years wool and mutton will give large returns to the farmer. This writer's advice is—keep sheep where possible. The farmer should take a thorough interest in his flocks, small or large. In Western Australia, where land can be had on very favourable terms, there are opportunities for mixed farming which do not exist in other parts of Australia; and when wire and netting are available, and provision made for water by huge dams or wells on the holdings, prosperity will be assured, for you have two sources of income—wool and wheat. Farmers who for years only relied on wheat and could not by any persuasive means be induced to purchase sheep, thinking they could not look after them and grow wheat at the same time, have followed the example of those who have done well, after seeing their big returns. They have informed me that they regret not having had sheep years ago. These people are increasing their flocks, both in number and quality of wool, type and frame.

Practical experience is the sure road to success, and by keeping sheep the owner is daily learning more about them, and copying others who have made a success with sheep. Become acquainted with your sheep, and learn by comparison with standard works and leading journals published on stock. These articles are the result of practical experience, extending over many years, of men who have acquired it after years of hard work. All this is available to the beginner to start off with, at little cost.

The climatic conditions of Western Australia are such that the Merino sheep will do well anywhere except on the southern and south-west coast country, where Longwools do remarkably well and would give better results than the Merino. If possible, when the first flock is purchased, buy from those who are noted for having sheep of quality, being large-framed, growing a fleece of long combing wool, that are bred on country similar to your own. Few mistakes can be made if this advice is followed. There are many different classes of sheep, and the farmer should try to keep his flock to type. If it can be avoided, do not buy a mixed flock that consists of everything in the sheep line, and expect to build up a flock that will give you big returns in wool. This is impossible from such a flock. Keep sheep that give you the best returns per head. Why keep sheep that cut you only 4 or 5 lbs. of wool per head when you can have a return of twice that amount and even more from good sheep? As an illustration, a farmer runs 300 sheep giving a return of 4lbs. wool per head. This is only equal to 150 sheep giving a return of 8lbs. per head. Look at the loss of feed used by poor-woolled sheep, compared with a few good ones that will give an equal return. All over our farming areas you can grow wool of high value for which there is a ready sale, by careful selection and breeding a large-framed sheep. Western Australia has proved its adaptability for growing wool from the South to the North, and as our lands are sparsely stocked millions of acres of land are available for settlement in almost every part of the State. The same land in a few years' time will be able to carry many millions of sheep. The Merino sheep is of a hardy constitution; it will stand almost any hardship and will live on anything such as bush or low scrub in bad times, providing it has plenty of water. Its good qualities are too numerous to particularise, but as a wool and mutton producer it stands unrivalled. It is the most useful sheep for the farmer and requires little attention. Study the feeds grown on your pastures and learn to know if your stock are doing well. You cannot learn too much regarding their requirements, and the owner who takes interest in their welfare must gain knowledge.

Do not eat out your paddocks before changing the sheep to another paddock. This mistake is often the cause of sheep losing condition through neglect, and often it has been thought that the sheep are not suitable to the land. That is not the case. Yearly, the experience gained by having sheep helps you to be more proficient, and it is within the power of every farmer to have a good flock that will yield big returns from wool and mutton. The farmer who has kept sheep for years is always glad to help the new man along with any knowledge he may possess. Attend to the details which, although simple, are necessary to know where sheep are concerned.

Western Australia is free from sheep diseases, and can grow sheep of good constitution. This is everything where breeding is concerned. In many cases where sheep do not thrive, it is not the fault of the pastures, but the class of sheep. What do they consist of? Every possible kind. How are they bred? It is hard to state, for the reason that they were never cared for or culled; just allowed to breed anyhow, year in, year out. Were the undesirable units of the flock ever taken away? Was new blood introduced? If not, how is it possible for a flock to be kept pure? Such breeding has one result—sheep of a weak constitution. This class cannot stand any hardships. They are the first to die when dry times come. The object of the farmer should be to raise and retain that sheep which will pay best for the consumption of its food. Strength, activity, constitution, and suitability of the pastures are the first objects for a breeder. Culling is of the utmost importance to get your flock up to a standard regarding constitution. Make up your own mind

what sort of sheep will best suit your district and climate—Merino, Cross-breds, or Longwools—and what you wish to breed. Having done this, stick to same and do not be led away by one and another regarding your line of breeding if you have one type. Do not buy a strange ram to mate with your flock unless you are certain that you have got the sire you need for selection. It is by this means that the advantage is to be reaped. No good flock ever existed that was not of a type. A type cannot be fixed by any other method than selection. Having decided on your type, let *uniformity* be your watchword. Do not purchase rams this year from one breeder and next year from another who has a sheep varying from its predecessor in some essential quality. By this means you might retard, if not altogether prevent, improvement in your flock. Therefore have a distinct object and stick to it; the mixed flocks which one sees so frequently will then soon disappear.

THE VALUE OF SHEEP CLASSING.

Sheep Classing.—This particular branch, which is most important, is often neglected or the classing is badly done by the sheep farmer. To be a thoroughly efficient classer, it is necessary for one to thoroughly understand and be able to recognise the various qualities and types of wool. The average sheep farmer can, however, with a little judgment, class his own sheep. It is every wool-grower's duty to class his sheep before shearing, and to cull his young sheep, so that in time to come he will possess a flock which is even, and as near perfection as possible. If the flocks are not culled, the undesirable units will retard its improvement. The sheep will soon deteriorate, and in time carry little wool. Some farmers contend it is unnecessary to cull the faulty sheep. What is profitable for the big sheep owner to do, applies also to the small one, whose aim should be to breed a flock, though small in numbers, yet of the highest quality. This particular work will more than repay him by the high return per head for wool, and by having a flock of large framed and strong constituted sheep.

The improvement that has taken place in the flocks of Western Australia of late years is the result of thorough and systematic sheep classing. Western Australia has to-day flocks equal to any in Australia, and the unrivalled position it holds for producing wool of high value has only been achieved by sheep classing. Our progress in sheep breeding has been recognised, when it is seen that Eastern States' breeders purchase our rams for their flocks. We have a country of great vastness, with a climate and rainfall more even than in any other part of Australia, suitable in every way for wool production and a large export trade in mutton when the freezers are completed. We are most favourably situated by being the nearest Australian port to the English and Continental markets.

The main object of classing is to reject any faulty sheep, or those of a type other than the sheep farmer wishes to breed. The best time to class the flock is before shearing; the sheep are then about full fleeced. Class your young sheep, the future breeders of your flock. The percentage of culls to be taken out will greatly depend upon the standard of excellence set in the flock. In some flocks the number of culls will be decided by the number of sheep the farmer can afford to dispose of. The usual percentage of culls which require taking out in an ordinary flock of young ewes is 25 per cent. to 30 per cent. As the flock improves the percentage lowers, and the standard of the culls improves. Sheep having any of the following defects should be culled out:—

> Small, under-sized, weak constituted, badly shaped, slab side, weak backed, narrow-chested, tucked-up appearance, long-legged, and carcase not in proportion to legs, and hollow and humped-backed or deformed sheep, also those having kempy hairs.

The wool on sheep of this class runs very coarse at the breech, and is full of long straight hairs, and is of low value. Sheep that are covered with wrinkles over the body should also be discarded. All sheep that are short-woolled, *i.e.*, with wool less than 1½in. in length at 12 months old, and those with loose open wool, lacking density, and which are not covered evenly, such as no wool

A Merino Ram growing black-tipped and heavy-conditioned wool—not suitable for the farmer.

on the head, and clean legged or wool of a dull yellow colour carrying an excessive amount of yolk, would be best rejected at classing time, as well as those with cross-fibred wool, which is of low value.

After classing, the sheep should be run past to detect any with deformities which had been missed. Do not breed from the culls. The most profitable thing to do is to sell those not required as ration sheep. The flock will then be uniform. Every year the farmer will have some of his aged ewes to sell, the young sheep taking their places In classing these old sheep, sound judgment should be exercised. From past experiences the unprofitable sheep and those which have outlived their usefulness, and do not compare with the best ewes of the flock, will be known. It pays to class, and keep on classing, and this has been proved. Aim for perfection and one type. By doing so, the return per head will be increased, and this will more than repay for the extra work amongst the flock.

With large flocks, and when a man has experience, it is best to have a pen or race about five or six feet wide filled with sheep, and the classer can work through each lot, raddling the culls, and as he does each race they can be run out and drafted up the ordinary race while he is working on the next race, and so on. The culls should, after drafting, be cull-marked, as prescribed by the Brands Act, with a slit at the tip of the ear or alternately a punch hole in the centre of the ear.

THE SELECTION OF GOOD RAMS.

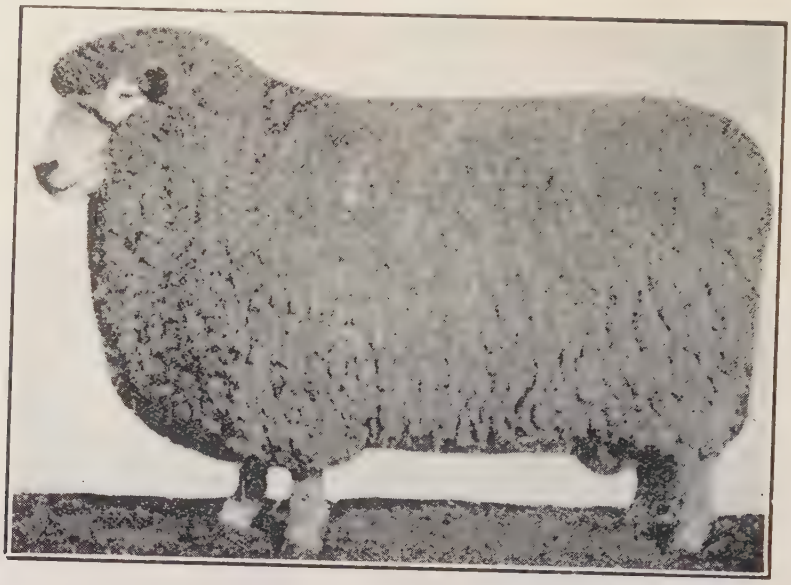
A good flock of ewes is useless without high class rams to mate with them. The rams should always be better than the ewes, and should be particularly strong where the bulk of the flock is lacking in order to counteract the deficiency. Breed for wool and frame, and endeavour to produce a strong, well-built sheep. A typical well-built Merino ram should be of a bold, muscular type. Why not allow his character in the wool? The ram should be thick in the neck, and the carcase round and free from wrinkles. The back should be even and straight, and not too long. The legs should be on the short side, with wool down to the hoofs. He should have plenty of width across the

A well-bred Merino Ram.

shoulders and loins, and the head should be in proportion to the body and covered with wool. The horns should not be too close to the head, the first curve being not less than an inch from the cheek. The face should be straight, with a good width between the eyes. The wool around the eyes should be clipped occasionally, so that it will not interfere with the sheep's sight. One of the most important things is the wool grown by the ram. It should have a long, sound staple, containing plenty of clean healthy yolk. It should not be dingy or discoloured. The ends of the staple should be free from black, hard tips. The staple should be straight and packed densely together. The wool should be fairly even in length and quality all over the body. The shoulder wool should be examined first, and taken as a standard. The wool on the remaining portions of the body should be as like it as possible in every way. The ram with wool that falls off much in length and density about the extremities and belly should always be rejected.

Select a ram with a full, bold, even front. He should move with a free healthy muscular carriage, and, if possible, these rams should be purchased from some reputable breeder. The best thing is to purchase good rams; the standard of your flock depends so much on the ram. Keep to the type established, and you cannot go wrong. There is no need for the farmer who com-

bines wheat growing with sheep raising to purchase his rams or ewes from the Eastern States; these sheep can be purchased at our local stud farms, situated in the vicinity of Katanning and Wagin, on the Great Southern line,



A well bred Romney Marsh.

Border Leicester.

and also round Moora and Geraldton, on the Midland line. The sheep from these studs compare favourably with the leading studs of the East. By purchasing locally, you can inspect the sheep you wish to buy, and also help the stud owners who have put thousands of pounds into high class stock.

ENGLISH BREEDS OF SHEEP.

In many parts of our State English breeds and cross-breeds are a success, some farmers keeping nothing but pure English breeds. The Border Leicester, Leicester, Lincoln, Romney Marsh, Shropshire, and other English

English Leicester.

Lincoln.

breeds have proved their adaptability in many parts of Western Australia. All these sheep have given good results when mated to the Merino ewe to produce early lambs. All English breeds and their crosses are suited to live

under farm conditions, but they must have an abundance of feed to maintain them in good condition. In selecting rams of the English breeds get a good typical ram of the breed you wish to keep, *always of pure blood* and sound constitution. Do not buy all the English breeds for your flock. If you do the result will be mongrel sheep of little value for either wool or mutton. When sheep are crossed in breeding it is hard to keep to type as they throw in all directions, though mostly resembling the sire.

A well-bred Merino Ewe.

In starting to breed a line of cross-bred sheep I would first procure a line of large framed Merino ewes and mate with the rams you have selected. The progeny of these would be half-bred. You will always get a proportion of sheep that are not suited, and it is impossible to get an even type from two distinct breeds. You must obtain the type you desire by culling. Mate the rams not later than the first week in December, and let them remain with the ewes not less than six weeks. The time should not exceed two months; a longer mating period would result in an unduly protracted lambing.

BREEDING FROM EWE LAMBS.

One of the greatest mistakes in sheep-breeding is the unfortunate practice of breeding from ewe lambs. The lamb makes its best growth in the first 12 months of its life, and if it is bred from under one year its growth is greatly retarded, and dwarfing must necessarily result.

In cases that have come under my personal knowledge, this practice has been the cause of the destruction of the flock; the size of the individual is checked, and the constitution weakened. Weight of fleece is reduced, and the percentage of lambs raised from ewe lambs generally is very low when compared with older ewes.

I would strongly recommend that this practice be discarded by all breeders, as, after all, constitution is the main thing in sheep.

LAMBING.

The percentage of lambs raised largely depends upon the care given by the sheep farmer to his flock during lambing period. The points to be remembered by him are—constant daily attention to the ewes; looking after newborn lambs insufficiently strong to help themselves, by giving them their first drink, etc., and providing shelter and shade in the lambing paddocks. Undulating country is the best for the latter, so that the ewes and lambs may escape exposure to the cold winter winds. The increased percentage of lambs and value of the sheep will repay the trouble.

WEANING THE LAMBS.

Allow the lambs as long as possible after marking before taking them from their mothers. Wean the lambs from middle October to November, according to circumstances. Always have the necessary paddock to receive the weaners, spelling for some time previously. They want the paddock with the softest and greatest variety of feed, with plenty of shade and water. It is most essential to see that these young sheep keep developing, as they never rightly recover if once they get a set back as lambs. Grass seeds are the lamb's worst enemies. There is no doubt that the shorn lamb does better in every way than the one left unshorn for the first year. The woolly lamb generally gets full of seed or burr, besides being more prone to the fly, and will not grow so well with the wool on, or do as well as when shorn. If the lambs are weaned at the shed when the ewes come up for shearing, the one drafting and mustering will do. Here each lot of ewes and lambs can be shorn as they are mustered. They can be drafted before entering the shed and a run of ewes and a run of lambs shorn, if the flock be large. The extra wool to be got by leaving the shearing of the lambs another month or two would not pay for all the trouble and expense of mustering, shearing, etc., unless it was a big shearing. When the lambs are shorn again at the following shearing, they have a fleece of hogget's wool with a level tip, denser and brighter and of more value than if they had been left unshorn, when the fleece would have a wasty tip, rather discoloured, and of much less value than the former. The separation of the sexes of the weaners can be carried out as they come up for shearing as hoggets. The ewes after shearing then become maiden ewes and are kept separate if the flock is large, after which they go to the rams, being then eighteen months to two years old. The wethers are either sold or kept for one, two, or three years before being sold.

CROSS-BRED AND ENGLISH BREEDS OF LAMBS.

These breeds require different treatment. When weaning these it is necessary to have good fences. If these lambs are to be held, they are better shorn. This class of sheep requires small pastures and plenty of succulent fattening feed, water and shade. These sheep being principally bred for carcase, the production of same as quickly as possible is the object aimed at. Where a few sheep are now pastured the carrying capacity in time will increase considerably by the growing of various feeds on the land. Added to the usual grasses, bush, etc., the fodder crop would enable the farmer to have sufficient feed during any time of the year. Work the holding to the best advantage for wheat and sheep, and the returns will more than pay for the extra work. Every farmer should have a small sheep yard, same being necessary for the easy handling of the sheep. (Plan herein shows a suitable yard.) The yard can be made at little cost from posts and rails, and once erected will last for all time. Same can be enlarged as the flock increases.

TICK AND LICE ON SHEEP—NECESSITY OF DIPPING.

Every farmer should look forward to the dipping of his flock. This is a matter of vital importance to the sheep industry of the State. Every owner of sheep must recognise in these times, when wool and mutton are so valuable, and the enemies in the form of destructive parasites are plentiful, that if allowed to remain such parasites are the cause of much loss to the owner financially, and to the State also. In our settled districts owners of sheep should be constantly on the alert to see that they are kept clean. This can be done by frequent examinations for tick and lice. When tick and lice became a pest in other parts of Australia the cost of eradication was considerable, apart from the losses to owners in wool cast from the sheep in paddocks, and the low value for tick-infested wool on the market. Should these pests prevail, could we estimate the decrease in wool and mutton values if allowed to go unchecked?

Regular dipping with proved poisonous powder dips is essential, and the instructions issued regarding them must be strictly carried out. Every sheep put through the dip requires to be soaked for not less than a minute. When sheep become lice-infested they will rub themselves along a fence or against a tree until the wool is torn from the backs or sides. They bite themselves to allay the irritation caused by lice, and in doing so pluck the wool from their bodies, raw sides being noticeable in places.

The farmer should dip his sheep from four to six weeks after shearing, and not a day longer. The value of dipping is considerable. Wool free from tick naturally brings higher prices than when infested with it.

Increased values are often lost through sheer neglect. In districts where farmers cannot afford a separate dip on each holding, the matter of installing one on the co-operative system should meet with general support. This can be erected at little cost to the interested parties. Every farmer must dip his sheep to keep them clean. This is compulsory, and most beneficial to the flock. The parasites mentioned will live anywhere, and will breed continuously on undipped sheep. Both tick and lice are frequently found on the same sheep. They live by sucking the blood from the unfortunate hosts. Sheep should not be dipped during extremes of heat or cold, when thirsty, or in a heated state from driving. When ewes and sucking lambs have been dipped, the lambs should be kept apart for a time.

SHEEP-DIP—"WALK IN" ENTRANCE (see Plan).

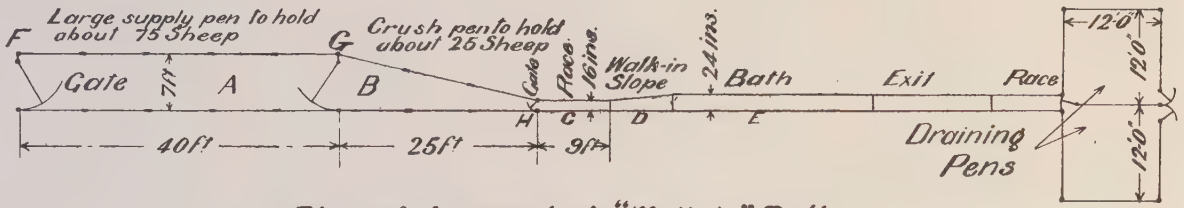
A and *B* are supply and crush pens, which are fed from the usual sheep yards, with which the former should be connected. The latter should have a battened floor, the battens being made in sections, so that they can be removed after dipping.

C, race, 9 feet in length, 16 inches wide, sufficient to hold four sheep. This race should have a battened floor, to be removed after dipping.

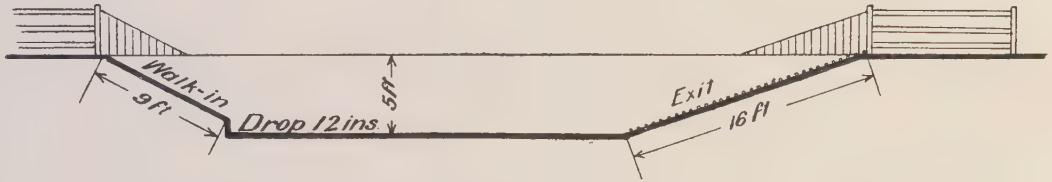
D represents the "walk-in" section, and is an incline 9 or 10 feet in length (10 feet is better), gradient one in two, ending in a drop of 12 inches above the bottom of the bath. Its width at the point at which it connects with the race is the same as that of the race itself, namely, 16 inches; hence it gradually widens to 24 inches, to connect with the bath at the other end, of which it practically forms a part. The sides of the "walk-in" section are also, in all respects, identical with those of the bath.

E, portion of the swim bath.

"Walk-in" Entrance Suitable for any Long Swim Bath



Plan of Approach to "Walk-in" Bath



Section of Bath with "Walk-in" Entrance

F, G, H, represent gates; *F* and *G* are 4 to 4½ feet gates hung on posts 3 feet or 2½ feet from the side fence, so that when open they will close up the angles and form a "lead in." *H* is a small gate to close the four sheep in the race.

Two draining pens, each 12 by 12, are necessary, and a shed could be erected over same if required.

The size of the above dip can be reduced to meet the requirements of the small stock owner. A dip from 15 feet to 25 feet long is large enough for a small flock.

THE NECESSITY OF SHELTER IN WINTER AND SHADE IN SUMMER FOR SHEEP.

Shelter and shade are things that should not be forgotten on the farm. I have often seen farms that are without timber, and the ewes in winter when lambing are exposed to wet and cold winds. There are considerable losses in lambs under such conditions. In summer the sheep will do better with timber for shade than resting in the open with the hot sun shining on them. Keep timber reserves of a few acres on your holdings, same being invaluable when sheep are pastured. If the timbers on our lands are destroyed, what of the future? Let us be wise in time and benefit by the mistake made years ago in other parts of Australia.

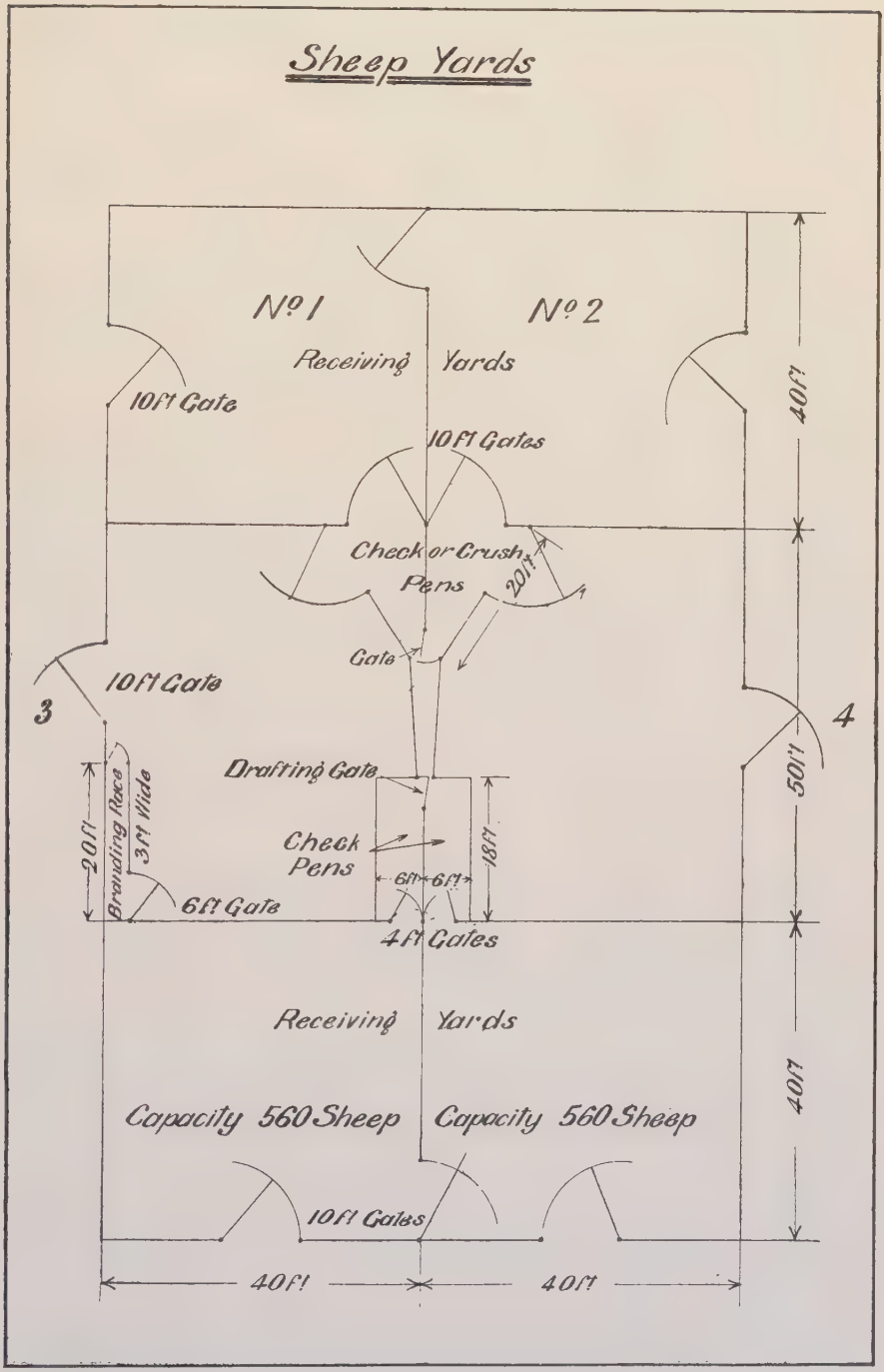
COMBATING THE BLOW-FLY.

The blow-fly pest has long since become a source of serious trouble to the sheep industry in Australia, and annually involves sheep breeders in heavy losses. In some years the mortality amongst sheep is much greater than in others, due largely to more favourable weather conditions for the breeding of the flies. Just before lambing time and during the wet season is the most dangerous period of the year. The sheep owner should watch the flock during this time for any sheep affected and attend to same at once.

A good method of prevention of the trouble is to crutch all your ewes by removing from the hind parts of the sheep all stained wool, etc. After being crutched the hind parts should be thoroughly well sprayed with a mixture of arsenical dip, and a quantity of castor oil in same will be found most effective in keeping the fly away. Experiments of jetting with an arsenical dip instead of crutching have proved most satisfactory in Western Australia.

CARE OF THE SHEEP SKIN.

After removing from the carcase, the skin should be hung out to dry—the skin takes from four to five hours to set—after which it should be painted so as to preserve the pelt against weevil. Paint the skins with weevil paint; care should be taken not to miss any part of the pelt. After painting the skins are ready to hang, so that both pelt and wool can become dry. The best and simplest method to adopt in drying is to hang the skins on rails. Place on the rails wool down and hang lengthwise from head to tail. After drying thoroughly the skins are ready for packing. It is necessary that they should be perfectly dry before being packed; if this is not so they are liable to taint and become damaged. Before packing cut off all trotters. The skins should be packed pelt to pelt, wool to wool, otherwise the pelt is easily damaged.


Sheep Yards
No 1
No 2
Receiving Yards
10ft Gate
10ft Gates
40ft
Check or Crush Pens
20ft
Gate
10ft Gate
3
4
50ft
Drafting Gate
Branding Race
3ft Wide
20ft
Check Pens
6ft
6ft
18ft
6ft Gate
4ft Gates
Receiving Yards
Capacity 560 Sheep
Capacity 560 Sheep
40ft
10ft Gates
40ft
40ft

SHEEP YARDS (see Plan).

There is nothing to prevent an increase in the number or the size of the receiving yards, so that the plan may be used by the owners of either a small or comparatively large flock. A man handling only a few hundred can put up a small yard on this principle, and the man who has to work from three to five thousand, by increasing the size can make it equally applicable. For that reason no actual measurements are given.

For a farmer with only a few sheep, No. 1 and 2 yards could be omitted, and receiving gates placed where marked 3 and 4.

WOOL SHED AND BARN (see Plan).

The illustration of a wool shed and barn shows a very convenient design for a small flock; let there be enough windows, as light is very necessary.

After each shearing this building can be used as a storage shed for grain, chaff, etc. The wool bins could be movable ones, and after use removed to a corner. Every part can be utilised.

For the future prosperity of the farmer in Western Australia a permanent number of sheep should be pastured on the farm year in and year out. Profits are made on the increase of those sheep and from the sale of the old ones. The farmer can then depend on a regular return from sheep, so much per head. This is better than dealing. A farmer must necessarily turn to mixed farming and grow crops of various feeds purposely for feeding the sheep. You have to feed every other animal on the farm, why omit the sheep? We have the land and it is necessary that we grow feed for the sheep that give such big returns.

FATTENING SHEEP FOR THE MARKET.

Many farmers in Western Australia do not pasture a permanent flock, but merely utilise the surplus growth of weeds and self-sown crops on their farms for fattening store sheep for the market. This naturally suggests itself to many land-owners.

For this purpose either ewes or wethers will serve; the latter will certainly realise the higher price in the market, but they cost more as stores and take, perhaps, longer than the ewes to put into prime condition. In buying wethers there is this advantage: they can be bought in the prime of life and in full vigour, whilst the ewes that are sold as stores—at a price that will pay for fattening—are frequently aged.

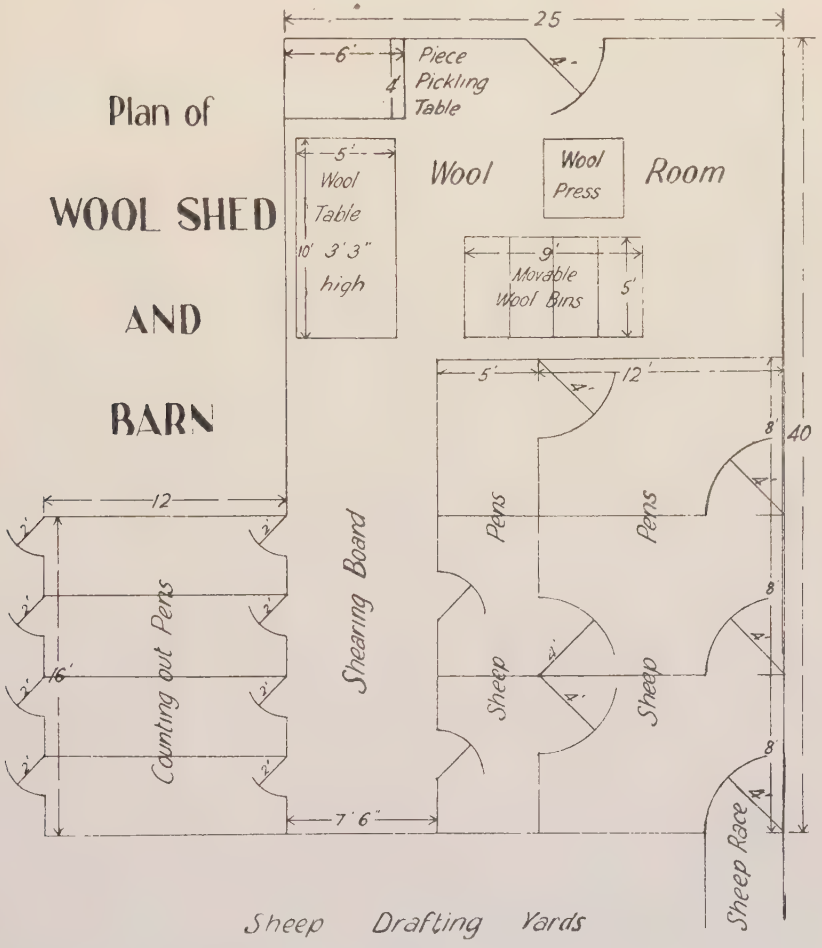
The grazier must be guided in the purchase of his stock by the local conditions and the ruling prices, which vary according to the season.

In making the selection care should be taken to see that all the animals are in the best possible health, of large well-shaped frames; undesirable animals never give satisfaction, and often sufficient food is wasted upon such sheep as would have fattened double the number of sheep with strong constitutions.

The farmer who purchase sheep to fatten often takes but little heed of the fleece, nevertheless, the wool has a considerable influence on the buyers at the sale yards. They know the difference between a good woolled sheep and a bad one.

In the wet parts of the State crossbred sheep will do much better than the Merinos and they, or the Long-wools, are well suited for fattening purposes in this country provided that they get plenty to eat without having to exert themselves too much to obtain same.

On our lighter and drier lands, with a less luxuriant growth of pasture, the Merino will often yield a better return than the cross-bred sheep, but in both cases much depends upon the choice of store sheep purchased, and this the grazier can only learn by experience.



When put in the paddock to fatten the sheep will be all the better if the owner goes quietly amongst them every day. This keeps them quiet and they settle down to feeding much more readily that when left entirely to themselves.

The sheep from the hot north will not do well on cold exposed country.

When buying sheep they should be, as nearly as possible, of the same age, even in size, and there should be no tail to the flock. To secure such a flock the farmer should be prepared to pay a higher price than for the ordinary run of stores.

The practice of fattening store sheep on the farms is becoming more general and wide-spread and now forms a very important adjunct to the pastoral industry, as will be seen by any person who attends the Midland markets each week. Many of these flocks may be described as mixed, but they leave the grazier a fair profit, and the quality of the farmers' flocks is steadily improving year by year.

YEARLY RECORD—WOOL ANALYSIS.

Number and Description of Sheep Shorn and Wool Produced.

Number of Sheep.	Description.	Number of Bales.	Total gross weight.			Weight of Packs.	Total net weight of Wool.			Remarks. General condition of the Wool.
			cwt.	qrs.	lbs.	lbs.	cwt.	qrs.	lbs.	

Numbers.	Grown Sheep.	Number of Bales.	Total gross weight.			Bales per 1,000 Sheep.	Average weight of Bale.			Average weight of Wool per head.
			cwt.	qrs.	lbs.		cwt.	qrs.	lbs.	
	Lambs									

Total Clip ... ...
Wool sent to scour ... ...
Scoured wool ... ...
Total greasy and scoured ... ...

THE IMPROVEMENT OF DAIRY HERDS BY THE USE OF REGISTERED PURE "TESTED" BULLS OPERATING IN ZONES.*

P. G. Hampshire, H.C.D.,

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The improvement of average cow production is of the greatest importance to the dairying industry throughout the world, and Australia in particular, in counteracting the set-back the industry has suffered since the war, due to increased costs of land, labour, foodstuffs, and materials required in dairy husbandry. The answer to increased production costs is increased unit production. The three principal factors in improving average cow production are: "Breeding," "Feeding" and "Weeding," and the main or basal foundation in the improvement of herds in type and production is breeding. Feeding, weeding or culling, handling and management are subsidiary. The foundation stone of the triumphal arch of successful dairying must always be breeding; all other additional stones in the edifice are of lesser importance, and the key to the arch which completes the structure may be likened to herd-testing, which becomes the key to successful breeding. Practically all instances of individual cow and herd increases and high production are the result of a steadfastness of purpose in breeding, namely, the concentration of one breed, using registered pure bulls whose dams and sires' dams are proved high producers. The value of the registered pure sire to improve common dairy stock, through their progeny, has been proved time and again, and admits of no argument. The registered pure dairy sire to "grade up" common stock represents the foundation of increased average cow production. Purity of blood is of great importance, in that it represents a dominance of pure, virile characteristics of one party to the mating which, because of their permanence, will displace the weak and less fixed characteristics of the other party to the union. The guarantee of purity is registration in an authentic Herd Book: purity without registration is as silver without the Hall Mark.

The influence of the registered pure dairy sire shown by an investigation into the records of Herd-Testing Associations in various parts of the world points definitely that herds headed by pure sires for a period of more than five years show greatly increased average milk production, and instances have been noted where the production has been as much as 1,500 lbs. milk and 85 lbs. fat per cow per lactation period higher than the production by herds headed by grade or mongrel bulls. Individual herd results have been noted which show production increase five years after procuring a pure bull, the members of the herd being the progeny of the original cows and equal to 120 per cent. increase in production.

Probably one of the most striking instances of the value of pure bulls in increased average milk production of cows is shown by the official figures published recently by the Department of Agriculture of America. The 48 States of the Union were divided into four groups of 12 States. The first 12 States, with an average of 51 per cent. pure sires, record an average production of 410 gallons of milk per cow per annum; the second 12 States, with an average of 31 per cent. pure sires, showed an average production of 330 gallons milk per cow per annum; the third 12 States, with an average of

* Paper read before the Australasian Association for the Advancement of Science (Agricultural Section), Adelaide, August 26, 1924.

19 per cent. pure sires, averaged 260 gallons of milk per cow per annum; and the last 12 States, with an average of only 12 per cent. pure sires, showed an average production of 200 gallons of milk per cow per annum. These figures, representing as they do the result of the production of nearly 25,000,000 dairy cows, are most eloquent in showing that increased production follows the use of pure sires.

Australia has approximately 3,000,000 dairy cows, an increase in average production of 10 lbs. butter fat per cow per annum, and at the average price of 1s. 6d. per pound paid for butter fat it is worth two and a quarter million pounds sterling. Australia has a big strength of co-operative organisation, and the industry is represented at dairy conferences by men of striking ability and organising capabilities, and a vast amount has been done in improving the manufacturing and marketing of dairy products. It is, however, felt that if this ability and organising experience were directed towards herd improvement a far bigger work could be accomplished in the advancement of the dairying industry.

The average annual production of cows in Australia according to the last figures published by the Commonwealth Statistician is as follows:—

	N.S.W.	Vic.	Qu'nsland.	S.A.	W.A.	Tas.
Milk, lbs. ..	3,300	3,300	2,330	2,940	2,010	2,980
Butter, lbs.	151	151	107	127	92	136

The next step in increased average cow production is the use of registered pure "tested" bulls. All pure bulls are not the progenitors of producing cows. Purity without production may be likened to a bucket devoid of milk. A dairy bull's value is his purity and the official production of his female ancestors. Purity and production is the combination. The higher the production of a bull's near female ancestors the greater his value as a dairy sire, and the greater the likelihood of his imparting to his progeny those productive proclivities. All bulls so bred do not improve their progeny, but averages of results are in the affirmative. The averages of herds have been increased from 130 lbs. fat in the case of the dams to 540 lbs. fat in the case of the daughters at each lactation. An instance is noted of the average production of all daughters of a bull being 250 lbs. fat higher than the average of their dams' production.

The results published in "The Dairy Farmer" of 1st June, 1924, under the heading of "Pure Bred Bulls and Production," show that in the State of Oregon, U.S.A., which has 49 per cent. pure "tested" sires, the average production of their cows has increased 17 per cent. during the last two years. The result of one Testing Association shows, where all pure bulls were used, that the average production of the cows ranged from 309 lbs. fat per cow per herd to 171 lbs. fat per cow per herd. All the highest herds under this association had been headed by pure bulls for a period of more than five years; the lowest herds were headed by pure bulls for a period up to five years, showing that their influence had not been felt. In seven herds, where pure-bred bulls had been used for 15 years, the average production per cow was 253 lbs. fat. In eight herds, where pure sires had been in use three years or less, the average production per cow was only 178 lbs. fat.

The next and most important step in increased average cow production is the use of registered pure "tested" bulls in *zones*. Zones, for their operation, become the natural corollary for the use of such bulls in "grading up." It obviously nullifies the good effects of the use of such sires if they are not used in a policy of continuity. The position as we find it in Australia par-

ticularly is that in the first place there is insufficient use of pure-bred bulls; secondly, there is comparatively a small number of farmers who use pure "tested" bulls; and, thirdly, the most serious of all, even when farmers are seized with the value of pure "tested" sires they change the breed with each mating. There are too few instances of a determined effort or a steadfastness of purpose in "grading up" by using such sires in a continuous policy with each mating. How often do we find a farmer hopelessly mixing the breed by the use of a bull of the different dairy breeds with each generation. The dairy farmer when starting cannot buy good type high producers, they are not available; but he can improve by breeding; and, even when he is seized with the value of the pure sire, it is fatal to breed on the lines that are often found, namely, starting off with, say, a Jersey bull; when this animal's heifers are old enough for breeding he looks around for another bull and is not particular about its breed, but because he has heard someone say that Ayrshires are hardier he buys an Ayrshire bull to mate with the graded Jersey heifers, and, when the resultant progeny of this cross are ready for breeding, a milking Shorthorn bull is procured with the idea perhaps, of getting more size or more saleable steers; and again, with the next generation, he may use a Friesian bull with the thought of increased milk flow, and after all these years of breeding he now expects an animal which has a combination of the advantages of all the breeds enumerated, viz., rich, high-testing milk; hardy, large frames, and heavy milkers. But what the farmer really has after his twelve or fifteen years of breeding is a mixed nondescript herd, all sizes, colours, types, and, worst of all, no improvement in production, but really a more definite mongrel than when he started, due to the conflict of type of each breed with each mating. On the other hand, with a defined system of breeding and the selection of a breed of sire to suit the climatic, pasturage, and marketing conditions for the produce, and a staunchness in keeping to that breed with each generation, a definite improvement is shown: the farmer has commenced a system of "grading up," and with each generation he infuses more pure blood and pushes out the low mongrel blood, attains type, an even colour, even size, and, what is of paramount importance, increased production. Further, when the pure sire used has female ancestry with high production capacity, the low producing herd at the start is built up to a high producing, highly graded and profitable herd, and the farmer has not only production but type also.

It is comparatively easy to improve future herd production through the progeny of low producing cows by the use of such bulls enumerated. It is more difficult, however, to improve on the production of high producing cows, and in making further advance bulls ex particularly high producing mothers must be used. Then there is the added zest to the man in herd improvement —pleasure and profit: pleasure in being able to point to his herd as something achieved—a herd of one type, even in size and colour—and profit, by increased returns from the cows. Improvement in constitution and size (if necessary), better shaped udders and placement of teats, are matters that may be rectified by the selection of sires whose "families" or "lines" are strong in the weaknesses of the cows to be mated, and, in the case of udder improvement being required, the dams of the bulls to be well developed in the particular weakness.

The need of a more defined system of herd improvement in Australia is apparent, and the zone system affords a solution of this most important subject. In Australia we have examples of the improvement of dairy cattle virtually by this system, such as the Milking Shorhorns on the South Coast of New South Wales, in parts of the North Coast of New South Wales, and

Queensland, the Ayrshires in certain districts of Victoria. Great improvement is noticed in the type and production of the stock in these districts really as a result of a system of "grading up," and the use of one breed of bull with each generation. Take the older dairying countries such as Denmark and Holland: there, one or two breeds of dairy cattle stand out, and no farmer would do other than use a bull of the particular breed he and his forebears have used with each generation of the herd. Again, in certain States of America one breed predominates, and invariably in the States that have the highest average production these two factors synchronise. The success of the majority of the dairy stud masters is, as a rule, due to a steadfastness of purpose in breeding, a concentration on one breed, and in all notable instances of high production, such as, for instance, the Milking Shorthorns of "Darbalara," the "Oakbank" Ayrshires, the "Wollongbar" Guernseys, and the "Glen Iris" and "Banyule" Jerseys, a high infusion of outstanding blood of the breed is maintained.

We have also in Australia instances of the great improvement made in Merino sheep, due to the long period of years of concentration in breeding by the use of high quality Merino rams; and in this respect the Merino sheep-breeder goes still further in his desire to concentrate and uses rams of one particular "line" of blood, whether it be "Peppin," "Murray," or "Koonoona" blood. We can imagine the horror of a Merino sheep-breeder in viewing the matter of using various breeds of rams with each generation, such as the "Romney Marsh," then "Lincoln" followed by "Corriedale," and then back to "Merino" again. The breeders of poultry, apart from show breeders, the men who are breeding for egg production, would not dream of mixing the breeds—using Leghorn roosters with Orpington hens and then, perhaps, Cochin China roosters subsequently. The same applies to horses and dogs; but, unfortunately, too long the average dairy farmer has been adopting the practice of mixing the breeds.

The zone system, which has been accepted in Western Australia, is designed for the purpose of having a concentration of blood of one particular breed in each zone or district, using as a basis pure-bred sires of the breed ex tested dams with production records above standard. The average dairyman cannot buy high production cows, but, with such a policy of grading up, results in regard to production and type will be attained ere long by using such sires on common ordinary cows to commence with.

The Western Australian Government has made it possible that pure bred for production bulls will be within the reach of every dairyman, and a policy has been set out accordingly.

Having convinced farmers that pure-bred sires are essential to progress, the natural corollary is zones for their operation. The breeds have been selected according to two main conditions, namely, suitability of country (climatic and pasturage conditions), and work required of the breed—"milk" or "fat." The districts near the metropolitan area, as the climatic and pasturage conditions are suitable, have been reserved for breeds such as the Milking Shorthorns and Friesian, on account of the large amount of milk these breeds give in comparison with the others; and the zones or districts at a great distance from the metropolitan area—which, in Western Australia, the land of great distances, will naturally be for butter production—have been reserved for the Jersey, Guernsey and Ayrshire breeds, according to the climatic and pasturage conditions.

In defining the zones, the writer conferred with the breeders and Royal Agricultural Society of the State, and the accompanying map is the result of their final deliberations, and has their unanimous support.

The zone system of breeding, apart from the concentration of one blood, is of great economic value in the mutual exchange of bulls by farmers when it is necessary to make a change in their dairy sires, all the farmers in the zone or district being owners of bulls of similar breed, thus saving "forced sale" of the old bull, often at a sacrifice, and there is no fresh outlay for a new bull, no high freight costs but merely "You take my bull, I take yours," and the added advantage of being able to again secure a bull which has been breeding high producing daughters. From the local Agricultural Show point

of view there is an improvement: districts become noted for their cattle, Jersey, Guernsey, etc., as the case may be, and this acts obviously to the commercial advantage of that district. Every farmer has one breed in a zone: greater interest will be shown in cattle exhibits; complete and full number of classes, and pens of heifers, cows (milking and dry), groups, etc., with big entries in each, instead of a few animals of each breed with no competition and no interest.

When the scheme was first launched in Western Australia only Milking Shorthorn, Jersey, and Guernsey cattle breeders had availed themselves of the official herd-testing scheme conducted by the Government, but, as the result of a series of conferences, the Ayrshire, Friesian, and Red Poll breeders intimated they were willing to submit their herds to the official test. The result is that, to-day, Western Australia has practically every registered breeder submitting his herd to the official test, and, as the State's dairy cows increase, it is anticipated that the stud breeders will be in a position to supply registered pure-bred bulls ex tested dams, which are the only bulls that are required, and in sufficient quantity to meet the requirements of the State.

It is recognised that Western Australia is in a fortunate position in regard to introducing such a movement, as, with the big dairying development which is in hand in connection with the group system of land settlement, there were comparatively few vested interests to be considered, and in introducing such a measure it would be easier in a new State than in an old one; but, however, it will be conceded that zones become the obvious corollary in the use of pure bulls, and are practicable. To have evaded the advantages of such a unique opportunity would have been criminal from an agricultural standpoint.

The conclusion to be drawn is that increased average cow production is of the greatest importance to the dairying industry of Australia to-day, and the principal factors in bringing this desirable improvement about is by the use only of *pure "tested" dairy sires* and a definite policy of "grading up," such as will follow by their operation in *zones*.

Conclusions.

1. The improvement of average cow production is without doubt the greatest factor in the progress of dairying in Australia to meet the increased cost of production. The answer to the increased cost of production is increased unit production.

2. The principal factors in improving average cow production are: "Breeding," "Feeding," and "Weeding."

3. "Breeding" is the most important, as it is the foundation stone upon which to build a profitable herd.

4. Practically all instances of increased milk and fat production in herds are shown to be the result of the use of better sires.

5. With common average cow herds a definite system of "grading up" becomes necessary. The slap-dash methods of mixing the breeds is fatal to improve production, owing to a conflict of the breeds with each mating.

6. Pure "tested" bulls or "standard" bulls are shown to be the great influence in increased production from results of all Herd-Testing Associations' records and statistics. Probably the most remarkable instance on record regarding proof that pure sires and production go hand in hand is shown by the recent figures published by the Department of Agriculture of the United States of America, as follows: "The 48 States of the Union were divided into four groups of 12 States. The first 12 States, with an average

of 51 per cent. pure sires, record an average production of 410 gallons of milk per cow per annum; the second 12 States, with an average of 31 per cent. pure sires, showed an average production of 330 gallons of milk per cow per annum; the third 12 States, with an average of 19 per cent. pure sires, averaged 260 gallons of milk per cow per annum; and the last 12 States, with an average of only 12 per cent. pure sires, showed an average production of 200 gallons of milk per cow per annum." These figures, representing as they do the result of the production of nearly 25,000,000 dairy cows, are most eloquent in showing that increased production follows the use of pure sires.

7. If we can increase the average production of each cow in Australia by ten lbs. fat per cow per annum, it is worth 2¼ million pounds sterling per annum.

8. The leaders of the dairy organisations in Australia might very profitably turn their attention and utilise their organisations in the direction of the improvement of average cow production. Australia's average cow is a low producer compared with cows of some of the leading dairying countries of the world.

9. The first step towards improved production is the *use of pure bulls;* the second step is the *use of pure "tested" bulls,* and the third step is the *use of pure "tested" bulls in zones.*

10 Purity without production is as a bucket without milk.

11. There is no value in using pure "tested" bulls if a change of breed is made with each sire used. A zone system of breeding is actually in operation in all the best dairying districts of Australia and other dairying countries.

12. The highest average cow production in the States of America synchronises with the States which have the highest percentage of pure bulls.

13. "Grading up" creates more interest to the dairy farmer, and combines pleasure and profit.

14. The high plane of Australia's Merino sheep is due to the concentration of one breed; and zones or districts afford a means of easy exchange of bulls, systematic "grading up," and greatly increased interest at provincial shows in each of the zones.

15. Western Australia has adopted the Zone System. To have missed the unique opportunity which presented itself would have been an agricultural crime.

WHITE CLOVER.

(*Trifolium repens,* Linn.)

W. M. Carne, F.L.S., and C. A. Gardner.

White, or Dutch Clover is not one of our common clovers. It is a perennial, and requires moisture during the summer months in order to survive. For this reason it is not very widespread, and is only naturalised in the moister waste places, summer pastures and lawns of the South-West districts. It has not spread into the drier areas.

In suitable localities, *i.e.,* where the soil is moist throughout the year, it is a most valuable pasture plant. Besides being one of the most nutritious of the clovers, it is one of the few perennial species that can be grown with Paspalum. The plant is very palatable, and stock are fond of it pre-

ferring it to most other pasture plants. White Clover succeeds better in heavy or loamy soils than upon sand, but does not grow well in soils that are inclined to cake hard on the surface, since the creeping stems cannot obtain a foothold in such soils. The plant makes its best growth during the Spring and Summer, and develops but little during the Autumn and Winter. In this respect it is later than Subterranean Clover. The species is of creeping habit, and does not attain any great height, seldom reaching one foot, but it possess a strong leaf growth, and recovers quickly after stocking.

For the moister parts of the South-West it makes an excellent pasture plant, and where the conditions are sufficiently moist it should be one of the principal constituents of the pasture. Owing to its lowly stature it can only with difficulty be converted into hay. As a pasture plant it may be grown as a pure crop, or mixed with other species. Top dressing (with phosphatic fertilisers) is essential if good results are expected.

A good pasture can be made from Paspalum (Water Couch), White and Strawberry Clovers, in heavy soils.

The following mixtures are recommended for drained or semi-swamp lands:—

For Spring sowing, Paspalum, White Clover and Lucerne. Where Spring sowing is not practicable, Paspalum, with Subterranean Clover, Alsike Clover, Cow-grass, and White Clover, sown in the Autumn.

In soil which is swampy or undrained, a good mixture is Lotus Major and Paspalum with which White Clover may be included. Spring sowing is advisable here.

For pure crops 5lbs. of seed per acre is sufficient; when sown with Paspalum 2lb. per acre, and, for mixtures containing other clovers, one to two pounds per acre will be found satisfactory.

Good results with White Clover have been obtained in Spring sowing one year after Paspalum, by distributing the seed on the surface, and allowing sheep to tread it in.

Mr. Prowse, of Capel, recommends White Clover as a pure crop stocked judiciously, since, owing to their partiality for the plant, stock are apt to select it from mixed pastures and keep it down.

The seed is very small, 40,000 to 50,000 go to the pound, and 60—65lbs. to the bushel. They are heart-shaped, flattened, smooth and yellow, usually tinted brown, or occasionally assume a greenish hue. Good germination should give 90 per cent. or more. The germination of samples received by the Department average 79 per cent., with a range of from 50 to 90 per cent.

In purity the seeds tested here average 97 per cent. The foreign seeds in these samples range from nil to 9,230 to the pound, averaging about 4,700. The principal foreign seeds consist of other clovers, mainly annuals: Rib-grass, Fathen, and Sorrel.

The main sources of supply are England and New Zealand.

Description of Plant.

A hairless perennial with prostrate rooting stems. Leaflets three, broadly ovate and usually marked with a crescent-shaped white stripe (see illustration), and finely-toothed margins, the veins not very conspicuous. The flowers are white, but are pink when in bud, and are loosely arranged in a head consisting of usually 30—40 flowers. The stalk of the head is longer than the leaves. Pedicels short and slender, reflexed after flowering. Calyx glabrous, 10-nerved with acute teeth usually erect. Standard twice as long as a calyx. Pod enclosed within the calyx, oblong, slightly constricted between the three or four seeds.

The plant is a native of Europe and Asia.

White Clover.
(*Trifolium repens*, L.)

Explanation of Plate:
A.—Plant.
B.—Flower (enlarged).
C.—Fruiting head (enlarged slightly.)

HORTICULTURAL NOTES.

Seasonal Work for July, August, and September.

GEO. W. WICKENS,
Officer in Charge Fruit Industry.

JULY.

In deciduous orchards the principle work claiming attention during this month is pruning, and though there are some growers who prune very lightly and others whose practice is just the opposite, whatever style is followed, it is essential that the work should be done in its proper season: so in spite of wet and cold weather which makes, at times, the work anything but pleasant, the secateurs must be kept going. In referring to the "proper season," I do not mean that the trees would suffer direct injury if the pruning is done late in the season, for, as a matter of fact, winter pruning can be carried out right up to the time when the buds are ready to burst without injuriously affecting deciduous trees, but the main reason for performing the bulk of the work in June, July, and early August is the necessity for cleaning up, in its season, the work of that season, and not allowing it to overlap the next season's operations. If pruning is delayed in winter, cultivating and spraying are delayed in spring, and in any period of the year, if work gets behindhand, it becomes very difficult for the worker or workers, to draw level again.

As I have before stated in the Horticultural Notes in the *Journal*, there are nearly as many styles of pruning as there are operators, but in spite of wide variations, there are certain fundamental principles underlying the practice which must be followed by all, and the main one is undoubtedly to Prune for Profit. To achieve this, each tree must be treated in such a way that it will produce a maximum quantity of fruit of good quality and marketable size. Leaders must be spaced so as to allow light and air to penetrate freely to every part of the plant, while guarding against over exposure, which results in sun burned bark and fruit. In the tree's earlier years care must be taken by moderately hard pruning to force growths from buds all along each leader's length and avoid bare spaces so often noticeable, but so unsightly and unprofitable, and in later years equal care must be taken in guarding against overcrowding of bearing buds and shoots which may produce many fruits, few of which are of good quality or marketable size. I am not ambitious enough to think these few notes will serve as a useful guide to anyone not conversant with the art of pruning, but I would strongly advise those growers who have little or no knowledge of it to communicate with the Orchard Inspector who supervises their particular district and arrange with him to give a practical demonstration and advice on the spot. More information can be gained in one hour by a beginner in this way than in a week spent in studying a text-book; but once a conception is gained of the habits of fruit trees and the manner in which the fruit is borne, from an explanation at, and demonstration on, the tree itself, a good text-book becomes a valuable aid and helps toward a better understanding of that vital principle "Pruning for Profit."

Wherever the land is not too sticky, planting deciduous trees should be pushed on with during this month. If the land is too wet for planting operations when the trees arrive from the nursery, every care must be taken to heel them in in moist (not wet) soil to prevent the roots drying out.

Citrus growers will be engaged this month in harvesting the crop of oranges; at time of writing (2nd June, 1925), it would appear that very few

oranges will be exported from Western Australia to London this year. The bad condition in which much of the fruit arrived last season and the low prices consequently received, have made many growers dubious about risking further consignments this year. So far as I have been able to judge, I consider the orange crop, on the whole, is lighter this season than last, but there is quite a sufficient crop to supply the local market and also provide a few thousand cases for export. It is to be hoped that some will be sent, for in a good cropping year, if the whole of the produce has to be placed on the local market there will be some very low prices recorded, and it is well to keep in touch with the London market by sending some forward each season.

I hope all orange growers when gathering fruit this year, whether for export or local market, will reduce rough handling to a minimum, for there is no doubt that our want of success in shipping oranges to London has been to a fairly large extent due to the rough treatment the fruit received at time of picking and packing.

It is to be hoped that all growers whose orchards are infested with San José Scale have followed the advice tendered in the notes published in the last issue of the *Journal*, and have already sprayed the trees once thoroughly, but if from any untoward circumstances this very necessary work has not been done, no time should be lost in completing it, for it is essential that all infested trees should be thoroughly sprayed at least twice during their dormant period. The Inspectors at the Ports this year had to refuse a permit to ship a number of cases of apples that came forward infested with San José Scale, and the growers who suffered need not have done so if they had only sprayed the trees thoroughly last winter.

All winter fruits should be watched carefully for signs of fruit fly infestation, and all fruit found to be infested should be destroyed by boiling.

AUGUST.

Pruning and planting of deciduous trees should be completed by the end of this month, and wherever the soil will work up without being puddled or rendered sticky, spring ploughing should be pushed on with.

Obtain scions for grafting purposes from bearing trees while they are dormant, during the early part of this month, and bury same in soil in a cool place to prevent the buds from bursting. Scions so treated will keep in perfect condition for grafting until the end of September.

Apply the second spray for San José Scale towards the end of this month, taking advantage of any fine weather which may be experienced. Where San José Scale and Woolly Aphis require treatment in the same orchard, use Black Leaf 40 and Lime Sulphur, as advised in notes for May in the previous issue of the *Journal*.

Continue the search for, and destruction of, citrus fruits infested with fruit fly, and carefully examine ripening loquats for traces of the pest. The weather in this month is usually too unsettled to allow of much success attending an application of poison bait to the trees, but should citrus fruits or loquats be found to be infested, bait should be applied on the first fine day afterwards.

Orange aphis was very prevalent last year; in fact it was present in many places in an unusual degree right through the summer. It will again commence to show up at the end of this month, and should be treated with Black Leaf 40 and soap, using 1lb. of the former and 3lbs. of the latter in 80 gallons of water.

SEPTEMBER.

This month is one of the busiest of the whole year for the fruitgrower.

Ploughing, cultivating, hoeing, spraying and grafting are the major operations requiring attention, and there are many minor ones which help to prevent the time from hanging heavily on the orchardists' hands.

Amongst the major operations mentioned, attention to Pear Scab (*Venturia pirina*)is one of primary importance, and to refresh the memory of those growers concerned, I recapitulate the advice given in the notes for September of last year:—"In districts where Pear Scab (*Venturia pirina*) is prevalent, it is imperative that the first spraying with Bordeaux mixture—6lbs. bluestone, 4lbs. lime, and 50 gallons of water—should be applied during the pinking stage of blooming; that is, when the majority of the blossoms are showing as a pink bud, and when only a few have burst into petals. If this time of spraying is missed, any number of sprayings later in the season will not give a good result. In many districts in this State, in ordinary seasons, the pinking stage spray is all that is required, but when wet weather continues a second spraying, after the fruit has formed, becomes necessary, using the same mixture, and in abnormal seasons, even a third may be needed some time later. When this last occurs, lime sulphur, at a strength of 1 gallon in 40 gallons of water, should be used, because Bordeaux applied at that stage of the fruits' growth may cause russetting.

Should there be any difficulty in obtaining freshly burned lime, 9lbs. of Washing Soda may be substituted for the 4lbs. of lime, making Burgundy Mixture instead of Bordeaux. A ready-made Bordeaux, "Schloesing's," has been used with very satisfactory results by some growers, while others have experienced burning of foliage following the application: from inquiries made it would appear that it is advisable to test the mixture with litmus paper or a clean knife before using, and if found necessary, sufficient washing soda should be added to neutralise the burning effect of the bluestone. The proportions to use and methods of mixing "Schloesing's," are supplied by the vendors with the material.

Where apple trees were affected last year with Powdery Mildew, spray with Atomic Sulphur, 1lb. in 10 gallons of water after the blossom petals have fallen.

Spray for Orange Aphis during this month.

Bait regularly for fruit fly from now onwards throughout the spring and summer in every orchard in infested districts as soon as the various fruits become sufficiently ripe to serve as a depository for the eggs of the pest.

Planting of citrus trees should be completed this month.

Graft over all old, obsolete varieties of pear and apple trees to varieties which will pay for their upkeep in the orchard, but only do this if the stocks are sound and healthy; an unthrifty stock will never result in a good tree, no matter how well the grafting is done. Use the strap graft, and if not familiar with it, ask the Orchard Inspector in your district for a demonstration.

Apart from low milk records, circumstances frequently arise which compel one to weed out cows from the herd; and the keeping of the herd up to anything like a standard is no light task. We have yet to prove that purchased stock are, or will do, better than stock raised on the farm, provided good judgment is exercised and great care taken in selecting it.—*Journal of Ministry of Agriculture.*

THE STICKFAST FLEA AND ITS CONTROL.

W. T. Richardson,
Poultry Inspector.

For the last two years the Stickfast Flea has been giving considerable trouble to the poultry farmers in the Welshpool district, so much so that a number of them were anxious to dispose of their properties on account of the extra amount of labour and expense incurred in trying to combat the flea with practically no results.

Mr. S. Dolman, of Division Street, was in that unenviable position. Those of my readers who have been visited by this pest and have their few fowls to treat will realise what it means to have to handle over 1,800 birds like Mr. Dolman did, by treating their heads with oil and spraying the fowl-houses with phenyle solutions, etc. If one application were sufficient to eradicate the flea it would not be such a difficult proposition to face. Experience shows that very frequent applications have to be resorted to if this pest is to be kept under control. Moreover, all poultry owners know that the more a hen is handled, particularly pullets, the less eggs will she produce.

In the spring of 1924 Mr. Dolman decided to put cemented floors in his fowl-houses. He experimented with a few of them and found the results so encouraging that the balance were soon similarly treated. A thorough inspection of his yards was made in February last, and amongst a large number of birds caught only one was found so slightly infested that his premises could be considered clear of Stickfast Flea. A further inspection in April after the first few showers, when this parasite is at its worst, gave the same gratifying result as on the previous occasion.

Mr. T. Boulter, Division Street, Welshpool, who carries about 900 head of poultry, was similarly placed. All or any treatment seemed of no avail. When he saw the results obtained by Mr. Dolman through cemented floors he decided to treat his fowl-houses in a like manner. An inspection of his yards in February last showed most interesting as well as instructive results. It must here be mentioned that some of his yards are in double sets and adjoining, with just the 2-inch netting in between, and some had the houses with cemented floors; others with just the bare sand. The birds in the yards with cement floors were quite free from flea, but those in the adjoining yards where the floors of the houses had not been cemented were in a very bad state of infection.

Since the above date Mr. Boulter has done the floors of the rest of his fowl-houses.

In April last a second inspection of this farm was carried out with the following notable results:—

The birds found free of infection in February last were still clean. Those in the yards where the floors of the houses had since been cemented were in various degrees of infection, *i.e.*, from clean to very bad according to the length of time the hard floors had been down. These remarkable results were obtained without recourse to treating the head of a single bird.

Mr. J. Davey, Division Street, Welshpool, adjoins the above property and has been poultry farming for a number of years. All houses were cemented shortly after their erection and no flea has been detected amongst his birds, with the exception of a brood of young chicks that were on free range and did not camp on hard floors.

These few examples, taken from a larger number, go to demonstrate that cemented floors are the most efficacious, the most lasting, and therefore the cheapest means of controlling the Stickfast Flea. Moreover, all fowl droppings can be saved and the birds have damp-proof houses, and, in consequence, are less liable to colds, roup, etc.

After a floor is cemented, about half and inch of sand should be spread over it. It will prevent—

(a) The birds standing directly on the cold cement in winter;
(b) The droppings from adhering to the floor; and
(c) Any egg from cracking that is laid off the perches.

The latter should not be more than 18 inches from the ground, 15 inches for preference.

Cement.

One bag weighs 125 lbs.; contains 1⅓ cubic feet, equal to (approx.) 2 kerosene tins full. (Cubic capacity of 1 kerosene tin: 0.69 cubic feet.)

Proportions.

1 part cement.
4 parts clean sand or small gravel free from clay.

One bag cement in above proportion will cover:—

1 inch thick	74 square feet.
1½ „ „	42 square feet.
2 „ „	37 square feet.

For houses up to 12ft. by 6 ft. of surface, 1 inch thickness of floor is recommended. For houses over that size 1½ inches to 2 inches, according to size.

LIMITING FACTORS AFFECTING PLANT GROWTH.

W. P. Cass-Smith, B.Sc.Agr.,
Agricultural Adviser.

A growing plant may be likened to a manufacturing concern, in which raw material drawn from several sources is subjected to a series of processes, until finally the finished article emerges. Provided the work proceeds smoothly the output is maintained at a regular rate, but if a stoppage occurs in any one department production ceases until such delay is made good.

The raw material of plant life is the food supply, which, on entering the plant, is gradually manufactured into new tissue.

If we trace the growth requirements of a wheat plant we can see where stoppage is most likely to occur. As the plant is alive it requires, *firstly*, an air supply to enable it to breathe. Breathing, however, is not confined to the stem and leaves, but takes place through the roots also, and hence the soil must be well aerated. *Secondly*, it needs a regular supply of raw food materials from which new tissue will be produced. Food is drawn from two sources—the air and the soil.

From the air the plant obtains carbon, which forms between 40 per cent. and 50 per cent. of its dry weight, and it has been calculated that an acre of wheat removes at least one ton of this substance from the atmosphere during its growth. As the supply of carbon in the air is unlimited it will not concern us here, and so we come to the second source of food—the soil.

When green, a wheat plant contains about 75 per cent. of water, which gradually decreases towards harvest, till only 16 per cent. remains. Water is thus one of the primary requirements of the plant from the soil.

Besides water there are seven substances essential to growth which the plant obtains from the soil, but in practice we find that only three of these—nitrogen, phosphorus, and potassium—are usually lacking. The supply of these in the soil is therefore of prime importance, as without them the plant cannot live.

Although the atmosphere contains about 80 per cent. of nitrogen, the plant cannot utilise it in the gaseous form. In the soil the plant obtains its nitrogen from two main sources—from the decaying vegetation of pre-existing plants, and from certain minute organisms of a specialised nature, which fix nitrogen from the air and convert it into a form readily available to plant life.

These organisms are of two kinds—those living in conjunction with leguminous plants, obtaining their food from the legume, and in return giving back nitrates, and those which live a separate existence. It is with this latter group of nitrifying bacteria that we have to deal.

The nitrifying bacteria in the soil feed on the vegetable matter present, and the energy they obtain from this source is utilised in changing atmospheric nitrogen into a form readily available for the plant. The value of this process to the farmer cannot be over-emphasised, as if properly controlled the need for nitrogenous manures is largely dispensed with on many of our soils.

To do their work properly these bacteria need air for breathing, a fair temperature, water to remove the products of their reaction, and the absence of acidity in the soil, which stops the reaction.

The control of this process is very largely in the hands of the farmer, and will be referred to later.

The action of nitrogen on the plant is very marked; it increases the vegetative or leafy portions and lays the foundation for a healthy, vigorous growth.

The supply of phosphorus is deficient in almost all West Australian soils, this deficiency being made good by the universal application of superphosphate. Phosphorus greatly increases the root development, and thus the drought-resisting powers of plants; and, in addition, makes them ripen earlier. In all except the lightest soils there is a sufficiency of potash, but on the latter dressings of muriate of potash may be beneficial.

Potash has a great influence on grain formation, and increases the proportion of grain to straw.

These, then, are the raw materials which the young wheat plant will utilise for its growth. They cannot enter the plant, however, unless they are in solution in water, which must therefore be conserved. In solution, they diffuse through the walls of the root-hairs and are transported to various parts of the plant, where after a series of chemical changes they are combined with carbon to form the different constituents of plant tissue.

The chemical changes which the raw-food materials are subjected to in the plant are greatly affected by temperature. The higher the temperature, up to a point, the faster these changes go on, and hence the rate of growth is quickened. In the laboratory growth ceases when the temperature is raised too high; but under field conditions this need not be feared. In practice, therefore, a high soil temperature will quicken the first growth of the wheat plant and make for earlier maturity.

The requirements for growth traced so far have been the presence of certain factors without which the plant could not live. There are, however, other factors upon the *absence* of which in the soil growth depends: these are injurious factors.

The injurious factor most common in this country is salt, and its effect upon plant growth is well recognised.

There is another harmful factor, which is more easily corrected (by the use of lime)—this is soil acidity.

We have now traced the requirements of the wheat plant during its growth and found that it needs—

(1) air for breathing;
(2) a food supply of nitrogen, phosphorus, and potash;
(3) a fair temperature, which regulates certain biological processes in the soil, and chemical changes in the plant;
(4) water to carry the food to the plant and to form a considerable part of its composition; and
(5) an absence of injurious substances which are toxic to the plant.

These, then, are the primary factors upon the presence or absence of which the growth of the wheat plant depends. As each one sets a limit to crop production, they are called "limiting factors."

It will be noticed that their action on the plant may take place in two ways—either directly, as in the case of air supply in the soil affecting the

respiration of the plant, or indirectly by affecting the conditions in the soil under which plant food (especially nitrogen) is produced, which in turn affects the plant growth.

Returning to our analogy between factory and plant, we saw that stoppage in any department delayed the whole manufacturing process and the output of the finished product. Similarly, if one of these limiting factors is adversely affecting the plant, the whole process of plant growth will be checked.

In order to understand this fully, let us consider the three limiting factors—air, food supply, and water—together, and their effect upon the plant under certain conditions.

Suppose the soil is rich in plant food, contains enough water for plant requirements but insufficient air, then the respiration of the plant is affected, and it cannot make full use of the rich supply of plant food in the soil. Air supply in this case is setting a limit to crop production.

The control of these limiting factors is largely in the hands of the farmer, as much depends upon the preparation of the seed-bed and correct use of manures. A good seed-bed should fulfil the following requirements:—

Firstly, it should contain an adequate air supply.

Secondly, it should contain a sufficiency of water, but not excess.

Thirdly, it should allow the nitrogen-fixing bacteria to carry out their beneficial work.

These requirements are observed by the following cultural methods:—

Fallowing early to get the benefit of winter rains and to open up the soil to the air.

Cultivating after fallowing (a) to destroy weeds, which use up the water and food supply; (b) to keep the soil well stirred, allowing air to enter and preventing water escaping, and (c) to allow the nitrogen-fixing bacteria in the soil to do their beneficial work.

Where the soil has a tendency to become water-logged, drainage should be carried out. When excess water is present the air supply to the plant is cut off, the soil is cold, carbon dioxide accumulates and adversely affects the plant by stopping nitrogen fixation.

Coming now to the control of plant food limiting factors, we find that, except on the light soils, superphosphate is the only manure needed, and applications of between 90 lbs. and 1 cwt. of this substance per acre will be sufficient to correct this deficiency. On the lighter soils potash may set the limit to plant growth, and a dressing of ½ cwt. per acre of muriate of potash will be beneficial. Acid soils containing toxic substances, which fortunately are few in our State, will be greatly benefited by an application of lime. Lime in these soils neutralises the acidity, liberates the plant food, and allows nitrogen to be stored by the organisms already mentioned.

From the control measures mentioned it will have been noticed that only under a good farming system, where fallowing, cultivation, and the judicious use of manures combined with drainage where needed, are carried out, can the requirements of plant growth be adequately met.

When this is realised and put into general practice our average yield will increase, and we shall occupy a higher place among the wheat-producing countries of the world.

CRACKING AND RUSSETING OF DUNN'S AND OTHER APPLES.

W. M. CARNE,

Botanist and Plant Pathologist.

In the September, 1924, issue of this *Journal* it was stated that the cracking of Dunn's and other apples was associated with a fungus (*Coniothecium* sp.). Growers were invited to conduct experiments to test whether the control of the fungus by spraying with fungicides would reduce the occurrence of cracking. The following is an outline of the experience gained during the past season:—

Infection Experiments.—Sound young fruit ¾ to 1 inch in diameter were infected with pure cultures of the fungus. The results were negative, neither russeting nor cracking nor other injury were produced. When the apples were injured the fungus established itself on the broken surfaces.

Field Occurrence of Russeting and Cracking, 1924-5.—The wastage from this cause was remarkably light last season, even on trees badly affected the previous year. Where it occurred it was usually confined to unthrifty trees.

Spraying Experiments.—Spraying experiments with lime sulphur were carried out by growers at Mt. Barker, Bridgetown, and Karragullen in conjunction with this Department on the lines indicated in the *Journal.* No definite reduction of the trouble could be traced to the spraying. The affected trees, whether sprayed or not, were almost invariably those of low vigour and with light crops.

Conclusion.—On the evidence available from the last few seasons, it would appear that the russeting and cracking of Dunn's and other apples is connected with climatic and growth conditions, and is not due to parasitic fungi. The fungus (*Coniothecium*) appears to be purely secondary, following but not causing the trouble.

It has become very marked that the cracking is most serious on trees which are not vigorous and bear light crops. It also varies from season to season, being apparently most marked in years of early and dry summers, and least when the summers are late and the early summer is relatively moist. This all points to the trouble being essentially one of sap movements in the plants. It is evident that little can be done to control the seasonal occurrence of cracking. In regard to unthrifty trees, however, it is clear that anything which will induce a more vigorous healthy growth will reduce the amount of loss. What the causes of lack of vigour may be can only be determined in each particular case. Bad drainage is certainly one of the main factors, and probably the most important.

There is no evidence that spraying is of any value in controlling this trouble.

DISTRICT CROP COMPETITIONS.

COMMENTS BY THE JUDGES.

Following upon the publication of the results of the Royal Crop Competition in the last issue of this *Journal*, the Judges' reports of the District Competitions are published hereunder:—

WONGAN HILLS DISTRICT AGRICULTURAL SOCIETY.

In this competition entries were received from Messrs. R. B. Ackland, T. Bowen, Spencer & Sons, and C. Parker. Another entry had been received in addition, but this was cancelled prior to my inspection, which took place from the 9th to 11th November.

Though the entries were not numerous, there was considerable interest taken in this competition, and it was very gratifying to find a strong spirit of friendly rivalry existing between the competitors. Such a spirit must result in having a beneficial effect on the methods and yields of the district and should therefore be encouraged to the fullest extent.

Messrs. R. B. Ackland and T. Bowen, by obtaining first and second places in this district competition, also qualify for entrance into the Royal Championship Crop Competitions in Zone 2.

The two leading crops were distinctly better than the others. They were well-grown and even, and showed no signs of receiving any check during growth, and were estimated to yield 36 and 34 bushels respectively. Apparently the dry weather during July and September did not affect them.

The winning crop was remarkably free from disease, and was much freer from weeds than the second crop, and Mr. Ackland ascribes this freedom from weeds to the consistent use of sheep, which are run on the paddock both before and on the fallow.

Messrs. Spencer & Sons' crop was comparatively free from weeds, but lost points owing to a few grassy patches, and further, had 6 points deducted because of it being the first crop. This crop suffered in yield as a result of being grazed by sheep far too long and too late.

The general conclusion is that the highest yields will not be obtained when the crop is grazed.

The seed used by all competitors was graded, and in consequence the crops were free from barley.

None of the seed planted had been treated to prevent smut, with the result that this disease was noticeable except in the winning crop. The risk that farmers run through not treating their seed must be drawn attention to and the fact that dry sowing does not prevent smut.

The winner's success is ascribed to the fact that the land was early fallowed, and all operations connected therewith carried out thoroughly.

There is a great similarity of the method adopted by the winning and second crops; this can be seen from the following table, wherein the details of all competing crops are tabulated:—

Particulars.	R. B. Ackland.	T. Bowen.	C. Parker.	Spencer & Son.
Years cropped ...	Half 4th. Half 10th.	8th.	7th.	1st.
Ploughed ...	June, July.	July, August.	July.	3rd-4th week Aug.
Plough	Mould-Board.	Mould-Board.	Disc. Cultivator.	Mould-Board.
Depth	4–5 inch.	4–5 inch.	3½–4 inch.	Up to 4 inch.
Condition when Ploughed	Good.	Good.	Good.	Hard toward finish.
Other Cultivation	Cultivated with Springtyne twice in spring, again after rain in December. Planted with Combine Drill.	Cultivated with Springtyne 1st week October, cultivated (Sundercut) after rain in November. Planted with Combine Drill.	Cultivated with Springtyne three times during spring. Back ploughed in March. Planted with Combine Drill, 3rd week in April.	Cultivated with Springtyne in spring. Planted with Combine Drill.
Variety	Nabawa.	Federation.	Federation.	Nabawa.
Planted	Half third week April; Half third week May.	First week May.	3rd week April.	1st week May.
Rate of Seed ...	57lbs.	60lbs.	60lbs.	60–70lbs.
Treated	No.	No.	No.	No.
Graded	Yes.	Yes.	Yes.	Yes.
Super	110lbs.	110lbs.	90lbs.	70lbs.
				Fed off by sheep in July.

WONGAN HILLS DISTRICT—1924.

Name and Address.	Variety.	Yield.	Freedom from Weeds.	Freedom from Disease.	Freedom from Admixture.	Evenness of Growth.	Total.
	Points ...	35	25	15	15	10	100
Ackland, R. B., Wongan Hills	Nabawa ...	35	23	14	13	8	93
Bowen, T., Wongan Hills ...	Federation ...	34	20	12	12	9	87
Parker, C., Wongan Hills ...	Nabawa ...	24	20	12	12	7	75
Spencer & Sons, Piawaning	Nabawa ...	25	16*	12	13	7	73

* Deduction—6 points first crop.

I. THOMAS, Judge.

TAMMIN DISTRICT AGRICULTURAL SOCIETY.

The competitors were Messrs. H. C. Holden, Meakin & Son, H. F. Cooke, R. B. Nottage, and H. R. Hocking; five other entries had been received, but these were withdrawn prior to inspection.

The winning crop (Mr. H. F. Cooke, Tammin), was outstandingly better than the others. It formed part of 500 acres of the variety (Nabawah). This land had previously carried gimlet and a little morrel. The whole area was well-grown and even, and practically free from weeds. There was no bunt, though there were a few patches of "take-all."

The second prize crop (Meakin & Son, Tammin), was similar to the first in that it was part of 500 acres of the Nabawa variety, planted on land that had previously carried forest. The yields of the two prize winning crops were estimated to be 33 bushels and 26 bushels respectively.

Cultivation methods adopted were similar in both cases.

Mr. Hocking is to be commended on gaining third place, he being handicapped to some extent by the character of his soil, which was light and had previously carried tammar scrub, ti-tree, and mallee.

Only one competitor treated his seed for bunt. This was Messrs. Meakin & Son, who used the dry method. Portion of the crop was entirely free from bunt, but the other portion was affected as if it had not been treated. It is evident that there was some defect in the treatment of the seed sown on the affected portion, but sufficient details were not available to enable me to account for the apparent failure of the method.

The other crops with the exception of that of Mr. Nottage, were free from bunt, indicating the seed used was not infected. Farmers who sow with untreated seed are, however, taking a risk which is unnecessary and can be avoided by sound and practical methods.

"Take-all" in varying amounts was found in all the crops. This emphatically points to a serious danger which can be avoided by the adoption of a better farming practice which includes a systematic growth of oats, in conjunction with the wheat crop, and the planting of the wheat crop after instead of before the rain.

Though the yield of the winning crop is good, it is believed that it could be increased by the adoption of more cultivation of the fallowed land, and these competitions are likely to have the effect of bringing this about and thus increasing the average yields of the district.

Messrs. Cooke and Meakin & Son automatically become competitors in the Royal Championship Crop Competition, and in this way these results and methods can be compared with those obtained from competitors in other districts in the same zone with approximately similar conditions.

The following table gives the various methods of cultivation adopted by competitors for comparison:—

Particulars.	H. T. Cooke.	Meakin & Son.	H. R. Hocking.	H. C. Holden.	R. B. Nottage.
Yrs. cropped	4th.	4th.	7th.	... ...	4th.
Timber ...	Gimlet and a little Morrell	Gimlet and Salmon.	Tammar scrub, ti-tree and Mallee.	Gimlet and Salmon.	Gimlet and little Morrell.
Ploughed ...	June and July	June and July	July.	July.	July.
Plough ...	Sundercut.	Mould-Board.	Sundercut.	Mould-Board.	Mould-Board.
Depth ...	4 inch.	4½ inch.	3 inch.	4–5 inch.	3 inch.
Condition at time of Ploughing	Good.	Little too wet; boggy in patches.	Good.	Little too wet; inclined to be boggy.	Good.
Other Cultivation	Cross cultivated Sundercut immediately after ploughing. Cultivated prior to seeding.	Cultivated Sundercut March and April. Planted with Combine Drill, with harrows attached.	Cultivated (Sundecrut) Sept., Springtyne cultivated shortly after and again prior to seeding. Planted with disc drill.	Cultivated Sundercut, Sept., again in Mar. Cultivated with Springtyne prior to seeding. Planted with disc drill.	Cultivated with Tandem disc in Aug., again in Sept. Cultivated prior to seeding with disc drill.
Variety ...	Planted with a hoe drill.	Nabawa.	Nabawa.	Nabawa.	Nabawa.
Planted ...	Nabawa.	1st and 2nd week May.	2nd week May.	Middle April and rolled.	4th week April.
Rate of Seed	1st week May	55lbs.	52lbs.	50lbs.	62lbs.
Graded ...		Yes.	Yes.	Yes.	Re-cleaned.
Treated ...	70lbs.	Dry Method.	No.	Dry Method.	No.
Rate of Super	Yes.	70lbs.	90lbs.	95lbs.	60lbs.
	No.				
	85lbs.				

TAMMIN DISTRICT AGRICULTURAL SOCIETY—1924.

Name and Address.	Variety.	Yield.	Freedom from Weeds.	Freedom from Disease.	Freedom from Admixture.	Evenness of Growth.	Total.
	Points ...	35	25	15	15	10	100
Cooke, H. F., Tammin ...	Nabawa ...	33	24	13	13	9	92
Meakin & Son, Tammin ...	Nabawa ...	26	23	12	13	9	83
Hocking, H. R., Tammin ...	Nabawa ...	24	22	13	13	8	80
Holden, H. C., Tammin ...	Nabawa ...	23	18	13	13	7	74
Nottage, R. B., Tammin ...	Nabawa ...	20	18	12	12	7	69

I. THOMAS, Judge.

KULIN AND DISTRICT AGRICULTURAL SOCIETY.

The awards made in connection with the Kulin and District Crop Competition are as hereunder:—

Name and Address.	Variety.	Yield.	Freedom from Weeds.	Freedom from Disease.	Freedom from Admixture.	Evenness of Growth.	Total.
	Points ...	35	25	15	15	10	100
James, L. & R., Kondinin ...	Nabawa ...	30	22*T	14	14	9	89
Trotter, A., Gnarming ...	Queen Fan ...	28	23	13	13	8	85
Meikle, P., Kulin	Nabawa ...	26	19*F	14	14	9	82
Hawkins, W. J. B., Corrigin ...	Federation ...	25	22	14	13	8	82
Wayne, W. R., Gnarming ...	Federation ...	25	21*S	13	7	8	74
Enwright, P., Kulin	Queen Fan ...	23	19*F	11	13	7	73
Nicholls, R., Kondinin ...	Nabawa ...	23	18	12	12	7	72
Lenton, V., Gnarming ...	Federation ...	22	18*S	12	11	7	70

* Deductions:—F. equals first crop, 6 points.
S. equals second crop, 4 points.
T. equals third crop, 2 points.

Between the first four competitors there was little to choose, and the character of these crops was excellent.

Messrs. L. & H. James won the competition with a crop of Nabawa, which was very free from weeds, disease, and admixture, and exceptionally even in growth. The variety was tall strawed, well headed, and nicely filled with plump grain.

Mr. Trotter, who came second, grew Queen Fan, also very free from weeds, but which contained a little more admixture and disease than the former variety.

Nabawa was also grown by Mr. Meikle (third), and except for the slightly lower yield compared very favourably with either of the winning crops.

The variety entered by Mr. Hawkins was Federation, which lost points on evenness of growth and admixture, the latter being a common failing of all crops of this variety inspected.

Owing to a mistake made when seeding, Mr. R. Wayne lost points for admixture, Queen Fan having been sown with the competition variety Federation.

Mr. Enwright's crop of Queen Fan contained a fair percentage of bunt and was uneven in appearance.

Weeds, consisting chiefly of wild oats, mustard, and cockspur, were numerous in Mr. Nicholl's crop of Nabawa, especially in crabholes where the plough had failed to enter.

Bunt, loose smut, and "take-all" were also found, the latter being in fair proportion.

Similarly Federation grown by Mr. Lenton contained the above mentioned diseases, and in addition a large number of mixtures of other varieties.

Cultural Methods.—A study of the cultural methods adopted by the winners of first and second places in this competition may be instructive, and shows close similarity.

The land was fallowed early to get the benefit of winter rains, and to enable weeds to germinate. Cross ploughing was then carried out, and in one case the land was cultivated also, afterwards being left till seeding.

Sowing was carried out in May, the combine drill being favoured on account of the labour saving nature, and the excellence of the seed-bed it prepares.

The seed sown by Messrs. L. & R. James was carefully graded, the benefit being apparent in the extreme evenness of growth which resulted.

Cultural Methods adopted by:—

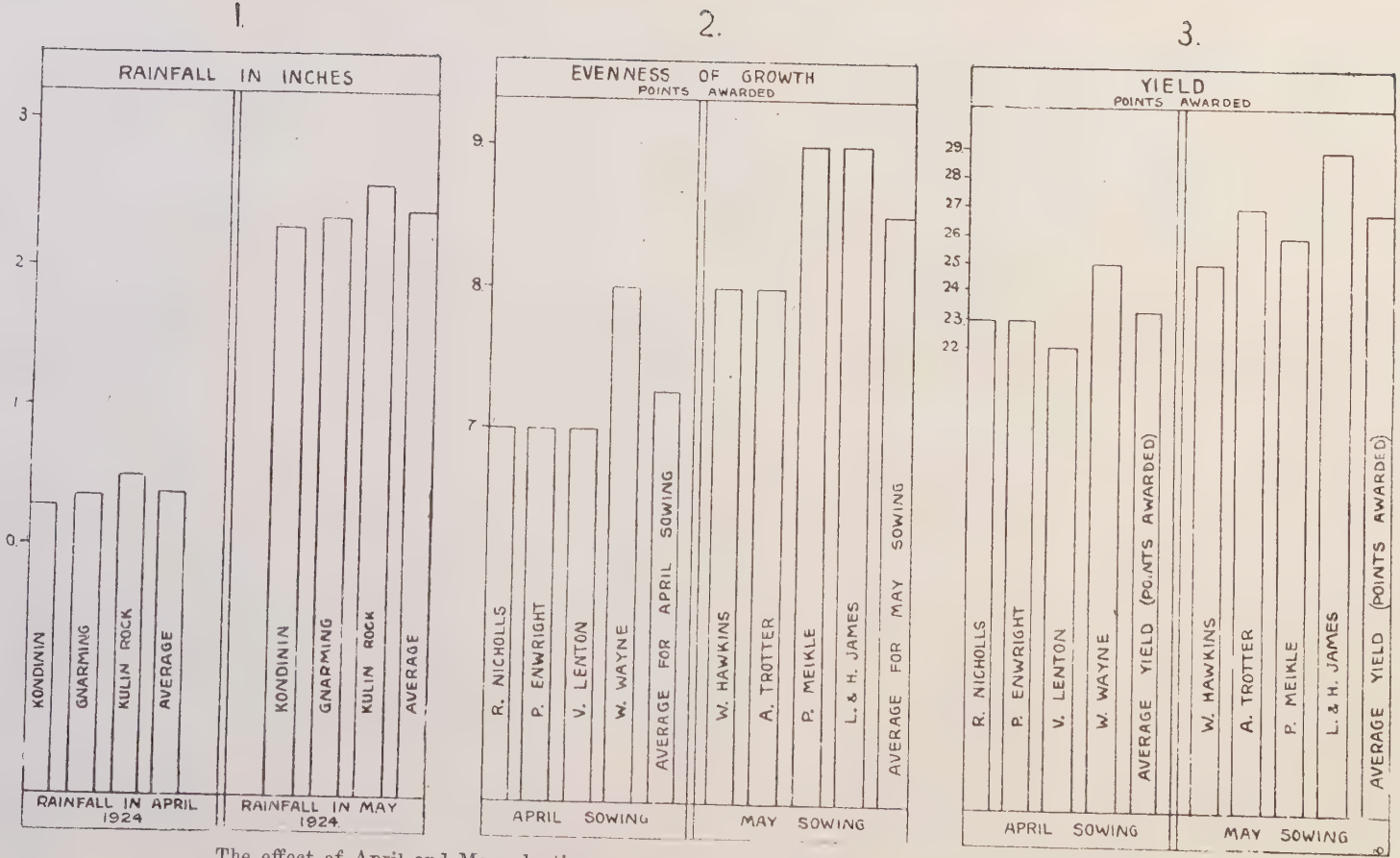
Messrs. L. & H. James:

Ploughed in July with disc to a depth of 4 inches.
Subsequent Cultivation: Cross disced in September, and springtyned at seeding.
Date of Planting: Early May.
Drill: Combine.
Rate of Seed: 45 lbs.
Rate of Super.: 56 lbs.
Pickled: Dry.
Seed Origin: Graded pedigree seed from Merredin Experiment Farm.
Harrowed after drill.

A. Trotter:

Ploughed in June with disc to a depth of 4 inches.
Subsequent Cultivation: Cross disced in August, cultivated with Tandem disc in October, and springtyned at seeding.
Date of Planting: Early May.
Drill: Combine.
Rate of Seed: 60 lbs.
Rate of Super.: 84 lbs.
Pickled: Wet.
Seed Origin: Local.
Harrowed after drill.

Although within the limits set by this competition, the variation in rainfall, over an average of years, is only slight, the time of planting varied considerably. On examination it was found that four competitors planted in April and the remainder in May. The rainfall during these months, taken at Kondinin, Gnarming, and Kulin Rock (which represents a fair average of the districts embraced in this competition) is set out in Graph No. 1. From this it will be seen that the average rainfall in April was 39, and in May 238 points. Thus the four competitors who planted in April did so under dry conditions, whereas the remainder planted during the wetter month.



The effect of April and May plantings upon the evenness of growth and upon the yield.

The effect of this is shown in Graph 2, which correlates the time of planting with the points awarded for evenness of growth. Thus the evenness of growth for April sown crop attained a seven point average as against an eight point average for May sowing.

The unevenness of crops planted under dry conditions appears to have had some influence on the yield.

In Graph 3 the points awarded for yields are plotted against the time of planting, with the following results:—

The average points for yield awarded to April sown crop was 23, and for May sown 26.

In the April sowings the only competitor who gained more than average points for yield was Mr. W. R. Wayne.

In this case it is interesting to find that cultivation took place after seeding, following rain, which resulted in the land not becoming set, and thus allowing better aeration and a more level germination.

The above conclusions, being the results of one year's observations only, cannot be regarded as conclusive, but it is pleasing to find that they lend a certain measure of support to the departmental policy of May planting (see *Journal of Agriculture,* Vol. 1, No. 1, page 62).

Conclusion.—The ultimate object of this competition is to raise the average of the State yield, by encouraging sound farming practice, and the initial success which has attended it is gratifying. Through the knowledge gained in the light of this competition, the tendency towards better cultivation is growing, and when this idea becomes more widespread the object set out above will be realised.

W. P. CASS-SMITH, B.Sc. Agric.

DOWERIN.

Immediately on arrival at Dowerin to judge this competition, I was impressed with the interest that was taken, not only by the competitors, but by the residents of the town—particularly by the secretary, who spared no effort to make my task as easy and as pleasant as could be. He had, as in previous years, arranged my itinerary and prepared a location map of the various competitors, thus enabling me to commence my tour of inspection without undue delay.

This is the third competition I have judged for this society, and it is very gratifying to find that increasing interest in being displayed. The effect of this upon the welfare and good name of the district must be beneficial because of the high yields which will be obtained in consequence, not only by the competitors themselves, but by the other farmers of the district who will, no doubt, follow their methods.

Of the ten competitors, one, Mr. F. Bear, of Minnivale, stripped his crop before my arrival, and that of Mr. Beresford was so obviously below the standard set for these competitions that it was not examined in detail.

The other competitors were Messrs. H. Jones, D. Place, A. W. Hewton, J. S. Jones, Allen Jones, Hughes Bros., C. E. Leehman, and J. Lindsay, and their crops were inspected on the 24th to 28th of November.

All the crops were grown on forest land which had previously been timbered with mainly gimlet and salmon.

It will be noticed by the points gained by the different competitors that the standard reached is now a high one and very uniform along the lines indicated by results of previous competitions in this district.

In view of the light July, and particularly September rainfall of from 35 to 70 points, spread over nine days, it was astonishing to find that the lowest yield was eight bags, whilst the yield of the winning crop was 12 bags.

The appearance of the crop gaining first place—Nabawa—was very striking, showing a solid mass of well-grown plants of nice stripping height, with well-filled heads, and practically free from disease.

The methods of cultivation adopted by the winner and other competitors are set out in the following table:—

TABLE A.—SHOWING METHOD OF CULTIVATION.

Particulars.	Hughes Bros.	Hewton, A. W.	Jones, Allen.	Lindsay, J.
No. of times cropped.	5 or 6.	At least 4.	6.	At least 6.
Timber.	Mostly Gimlet.	Gimlet and Salmon.	Gimlet and Salmon.	Salmon and Gimlet.
Ploughed.	July.	July.	June-July.	June-July.
Make of Plough	Mould-Board.	Mould-Board.	Mould-Board.	Mould-Board.
Depth.	4 inch.	4 inch.	4 inch.	4 inch.
Condition at ploughing time	Good.	Good.	Good.	Good.
Other Cultivation	Cultivated (Sundercut) in Sept. Harrowed after rain in Dec. Springtyne cultivated after rain in April, prior to seeding.	Cultivated twice in Spring with Springtyne T-bar, rolled six weeks before seeding. Cultivated prior to seeding.	Cultivated twice in Spring, once in early summer with Springtyne again in May. Planted with combine drill.	Cultivated in September with tyne cultivator, again during summer after rain, and again prior to planting. Planted with Combine Drill.
Variety	Nabawa.	Nabawa.	Nabawa.	Gluyas Early.
Planted	1st May, and harrowed.	2nd week May, and harrowed.	2nd week June, and harrowed.	3rd week May.
Rate of Seed	45lbs.	60lbs.	65lbs.	50lbs.
Treated	No.	Bluestone.	No.	Bluestone.
Super	110lbs.	70lbs.	130lbs.	90lbs.
Graded	Yes.	Re-cleaned.	Yes.	Yes.
Disease	None.	Trace "Take all."	Trace Smut.	Trace "Take all."

Particulars.	Place, D.	Jones, S. J.	Lehman, C. E.	Jones, H.
No. of times cropped	At least 5.	10.	8.	15.
Timber	Gimlet and Salmon.	Mostly Salmon and Gimlet, a little mallee.	Morrel, Gimlet and Salmon.	Salmon and Gimlet.
Ploughed	July.	July.	July.	June.
Make of Plough	Mould-Board.	Mould-Board.	Disc.	Mould-Board.
Depth	4 inch.	3½ inch.	4 inch.	4 inch.
Condition at ploughing time	Good.	Good.	Good.	Good.
Other Cultivation	Cultivated with Springtyne August and September. Twice cultivated and harrowed prior to drilling, again harrowed.	Harrowed after ploughing Cultivated twice in October again December, first week in June, and planted with Combine Drill.	Disced September, Springtyned and harrowed in October, cultivated again with springtyne, month prior to planting seed with Combine Drill.	Cultivated after ploughing (Sundercut). Before planting drilled and harrowed twice.
Variety	Federation.	Nabawa.	Gluyas Early.	Pennys.
Planted	2nd week May.	2nd week June, harrowed three days after.	3rd week May.	2nd week May.
Rate of Seed	60lbs.	45lbs.	55lbs.	45lbs.
Treated	Bluestone.	No.	Dry.	No.
Super	90lbs.	90lbs.	70lbs.	120lbs.
Graded	Yes.	Yes.	No.	Yes.
Disease	Trace Smut.	Traces loose Smut and "Take-all."	Trace "Take all."	"Take-all" patches and Bunt scattered.

The uniformity of methods adopted will be noticed. It will be seen that the cultivation consists of ploughing the land 4 inches deep, cultivating in all cases in spring and again in autumn. The winner also harrowed his land after rain in mid summer.

With the exception of the winner, the planting of the other crops was done not earlier than the second week in May; that of the winning crop was during the first week in May.

The rate of seeding ranged from 45 lbs. per acre in the case of the winner, to 65 lbs. in the case of Mr. Allen Jones, who obtained third place with a yield of 34 bushels and planted as late as the second week in June.

The fertiliser in all cases was superphosphate, 22%, ranged from 70lbs. to 130lbs. per acre.

No definite information is available regarding the profitable amount to use, but the larger amount has no injurious effect upon the yields.

Four of the competitors did not treat their seed to prevent smut, and three of these crops showed traces of smut, illustrating the risk which is taken in planting untreated seed.

Mr. Lehman was the only competitor using the up-to-date dry method with carbonate of copper, and it is believed that the competitors who used the bluestone method of treatment reduced the yield, because of the lessened vigour which the seed has when so treated.

In one case where the seed was treated with bluestone, traces of smut were also found; this is believed to be due to the method and not to the inefficiency of the treatment.

It is pointed out that the dry treatment with carbonate of copper has been proved to be superior to the wet bluestone, and Mr. Lehman is to be congratulated on being the first of the competitors to use this method.

I would like to point out that Mr. Lehman was the winner of the competition last year and, I believe, suffered in yield owing to reduced rainfall which that part of the district had, 35 points only being registered for September.

In the majority of the competing crops traces of "take-all" were noticed. This points to the need of farmers in this district to pay attention to farming practices which will eradicate or at least control it.

Messrs. Hughes Bros. and Hewton—by obtaining first and second places in this competition—now represent this district in the Royal Crop Championship Competition in Zone 1.

DOWERIN AGRICULTURAL SOCIETY—1924.

Name and Address.	Variety.	Yield.	Freedom from Weeds.	Freedom from Disease.	Freedom from Admixtur.	Evenness of growth.	Total.
	Points ...	35	25	15	15	10	100
Hughes Bros., Minnivale ...	Nabawa ...	35	23	14	14	9	95
Hewton, A. W., Minnivale ...	Nabawa ...	33	23	13	13	9	91
Lindsay, J., Wyalkatchem ...	Gluyas E. ...	31	22	14	14	9	90
Jones, A., Ejanding ...	Nabawa ...	34	21	13	13	9	90
Place, D., Dowerin	Federation ...	33	21	12	12	9	87
Jones, J. S., Ejanding ...	Nabawa ...	28	19	12	14	8	81
Leehman, C. E., Dukin ...	Gluyas E. ...	24	19*	13	14	7	77
Jones, H., Dowerin	Pennys ...	26	17	11	12	7	73

*Deductions—2 points third crop.

I. THOMAS, Judge.

BRUCE ROCK.

I have pleasure in submitting my report as Judge of the crops grown on the fallow connected with the above competition.

This competition, being the first of its kind in the State, one feels the Bruce Rock Agricultural Society by inaugurating same recognises that the time has arrived when a concerted effort should be made, by a practical demonstration, and information gained to prove that the pioneering stage is past and good farming must replace the rough and ready wheat growing methods if our average yields are to be increased, and therefore rise to that position we should attain amongst the wheat producing States of Australia.

It is by these competitions, where the farmer treates the 50 acres in competition somewhat more scientifically than he does his bulk areas, proof will be shown that 200 to 250 acres of wheat per team, sown on well-worked fallow—preferably after rain—is better than 500 acres scratched in on stubble or than 400 acres on rough fallow.

Having judged the fallow in March last, and a report published, I was indeed pleased to know that I had to adjudicate upon the crops grown thereon, so as to see if my comments on the various sections—such as moisture, irregular cultivation, cultivation after summer rains, and so on—were borne out by the crop. The irregularities could be traced in almost every entry.

The Season.—This was not a favourable one. The first good rains were late, not falling until the middle of May. This meant a large proportion of the district was sown dry without serious consideration as to whether the stubble or fallowed land was full of weed seeds ready to germinate with the wheat. The succeeding months were ones of anxiety to the farmer for, although the rain fell at fairly regular periods, the falls were not such as to give any surplus moisture in the soil should a dry period intervene towards the end of the season. This happened in September, and those crops which were not able to receive the benefit of a plentiful supply of soil-conserved moisture showed more disease, stunted growth, and grainless heads, due mainly to the lack of moisture necessary to the plant food in the development of the grain during the innoculation period. Those crops on the fallow which had received attention after the December and February rains appeared not to have suffered, but many of the others were only saved by the exceptionally favourable timely showers in October and lengthy cool ripening period.

Varieties.—It is pleasing to see that the varieties recommended by the Department occupy such a large acreage in this district, and the value of the stud seed is recognised as a means for obtaining an increased yield.

The varieties Nabawa, Gluyas Early, and Merredin held pride of place as midseason and early wheats, and farmers will do well to continue growing them until they are convinced that better varieties are available. Constant endeavour is being made to improve these standard varieties, but before sowing large areas of new and inconsistent old varieties, systematic trials on small areas with the above-named as a check or control are advisable.

The Awards.—The first prize, a Cup valued at £8 8s., is awarded to the competitor obtaining the highest aggregate number of points for 50 acres of fallow and crop grown thereon.

The coveted honour is gained by Mr. J. Lethlean, and Messrs. P. McCarthy & Son obtained second place with only one point less.

It is interesting to note that Mr. Lethlean's position after the judging of the fallow was second to Messrs. McCarthy & Son by two points. In the judging of the crop the former beats his opponent by three, and in the aggregate by one.

The variety chosen by Mr. Lethlean was Nabawa.

There was a striking illustration in this crop. Twenty acres were planted with stud seed before the rain. The stiff patches referred to in the fallow report—with large clods on the surface and insufficient fine soil beneath—could be picked out owing to irregular inconsistent germination, but on the 30 acres sown after rain, and the cultivator preceding the drill—these patches were hard to find, and the line showing the seeding before and after rain was plainly visible.

The weeds were few, mostly on the 20 acres dry sown.

It was a nice even crop, very few mixtures and absence of disease. The heads were well filled and practically no sign of the crop having suffered much during the dry period.

Sowing was started during the second week in May, when 20 acres were completed. Rain fell on the 12th (53 points), and on the 14th (140 points), delaying seeding until the 19th. Seed sown at the rate of 45 lbs. with super 90 lbs. per acre.

The rainfall from the commencement of fallow in June, 1923, to 30th April, 1924, totalled 1,319 points. During the growing period, 1st May to end of October, 1924; the total was 1,107 points.

Messrs. P. McCarthy & Son's crop of Nabawa from a casual glance on the outside appeared to be a very nice even one, very well grown, and well headed with plump grain, but on a systematic examination more weeds were encountered than in the leading crop; these consisted of thistles, mustard, and cockspur, with patches of take-all, which caused an unevenness of growth as shown by the allotted points.

This crop, as the fallow report shows, was grown on summer fallowed land and five crops had been taken off, but only twice fallowed, also butts of self-sown crop having been cultivated out and left lying on the surface. There is a possibility that the "take-all" was increased therefrom.

An interesting illustration was seen on this farm by summer fallowing with a mouldboard plough and a heavy "duckfoot" cultivator for the early germination of weeds. That portion worked with the cultivator showed earlier germination and thicker growth. Sheep would play a great part in keeping this early germination and thick growth of weeds in check, and when the summer fallow is winter ploughed early after seeding, the humus returned to the soil would be considerable.

Seed was sown with a Combine drill with light harrows attached, at the end of April, at the rate of 60 lbs., with 90 lbs. super. to the acre.

The rainfall from the commencement of the fallow in March, 1923, to 30th April, 1924, totalled 1,445 points. During the growing period, 1st May to 31st October, 1924, the total was 931 points.

A comparison of the rainfall received by the blocks entered by these first two competitors in this competition is worthy of attention.

Mr. Lethlean's block is situated close to Bruce Rock township, and Messrs. McCarthy & Son's seven miles West of that centre.

Messrs. B. Althom, with Merredin variety, and H. J. Yelland with Gluyas Early, tie for third place. Mr. Yelland lost his advantage of one point in

the fallow award by having a larger percentage of wild oats than Mr. Altham, otherwise the crops were very similar.

The details of award show the points allotted and indicate the position of the other competitors.

In conclusion, I must record the interest most settlers evinced by seeking information from the judge in connection with their farming operations irrespective of the block in competition, and their readiness to assist in his itinerary.

BRUCE ROCK DISTRICT AGRICULTURAL SOCIETY.

Name and Address.	Variety.	Yield.	Freedom from Weeds.	Freedom from Disease.	Freedom from Admixture.	Evenness of Growth.	Total.	Total for Fallow.	Aggregate Total.
Points ...		35	25	15	15	10	100	100	200
Lethlean, J., Bruce Rock	Nabawa ...	35	23	14	14	9	95	79	174
McCarthy, P. & Son, Eujinyn	Nabawa ...	35	22	13	14	8	92	81	173
Altham, E., Yalbarrin	Merredin ...	24	21	13	12	8	78	76	154
Yelland, J. H., Bruce Rock	Gluyas E. ...	24	20	13	12	8	77	77	154
Hedges, W. H., Koobberin	Nabawa ...	26	21	13	12	8	80	67	147
Farrell, F. C., Eujinyn	Nabawa ...	27	20	13	12	8	80	66	146
Brown, S., Bengullapin	Nabawa ...	27	20	13	12	8	80	63	143
Mullane, Ardath ...	Nabawa ...	24	20	13	12	7	76	63	139
Smith, C. & A. H., Yalbarrin	Nabawa ...	24	20	13	11	7	75	61	136
Iles, J. W.	Withdr'n ...	...	...	...	...	...	...	68	...
Brown, W.	Withdr'n ...	...	...	...	...	...	...	67	...
Smith, C. & Son ...	Withdr'n ...	...	...	...	...	...	...	66	...
Packard, J.	Withdr'n ...	...	...	...	...	...	...	64	...

H. RUDALL, Judge.

DALWALLINU.

This is the first competition connected with the above society. It was conducted under the same conditions as the other district societies' competition, except that the area was 25 instead of 50 acres, hence the first and second prize winners were debarred from automatically entering for the Royal Agricultural Society's Champion Prize in No. 1 Zone.

The competitors numbered 10. These were reduced to three by local judges, who prior to my visit had inspected all competing crops. The remaining competitors were: Mr. J. Harris, Dalwallinu; Mr. H. Richardson, Miling, *via* Pithara; and Messrs. Bradford Bros., of Ballidu.

In each case the land had originally carried gimlet and salmon gum timber.

The land had been fallowed in 1923, two competitors using the disc cultivating plough and the other, Messrs. Bradford Bros., preferring the heavy disc plough.

In each case the subsequent cultivations were the same, viz., after ploughing and prior to seeding, two competitors using the Springtyne cultivator, and Mr. Richardson the disc cultivator for the first cultivation.

The crops of Messrs. Bradford Bros. and Mr. J. Harris were sown in May, whereas Mr. Richardson sowed his early in April.

Rate of seed sown was from 50 to 60 lbs. and super. from 60 to 90 lbs. per acre.

In one case only was the seed treated for bunt, but in all entries it had been re-cleaned or graded. The weeds noticed were mustard and black oats, but these were not sufficient to have interfered with the growth of the crop. Mr. J. Harris' crop was particularly free from wild oats. A few odd heads of flying or loose smut were noticed in one of the crops. Although no smut was noticed in the crops, no farmer should conclude that it is unnecessary to treat the seed for this disease. The risk is too great.

Now the dry method has proved so effective, the inconvenience is nil when it is realised that the seed can be treated immediately after harvest or any time between then and seeding. The admixture in each entry were only a few stray heads of another variety. A little barley was also noticed. All care should be taken to keep the crops free from barley owing to the dockage made when placed on the market.

The first and third placed crops were very even in height and had stooled well, but in both cases a few tipped patches caused by ash-heaps were noticed. In the sowing of Mr. J. Harris' entry care was not taken to see that the drill lapped, as patches were noticed in places a foot wide where the drilling had been missed.

The germination in Mr. Richardson's entry appeared to have been somewhat irregular as some of the growth seemed to have got away early and made vigorous progress.

The feature outstanding throughout this competition was the regular germination, stooling, and evenness of growth shown by the May planting.

DALWALLINU AGRICULTURAL SOCIETY.

Competitors.	Variety.	Yield.	Freedom from Weeds.	Freedom from Disease.	Freedom from Admixture.	Evenness of Growth.	Total.
	Points ...	35	25	15	15	10	100
Bradford Bros.	Nabawa ...	32	20	14	12	9	88
Richardson, H.	Nabawa ...	32	20	13	12	8	86
Harris, J.	Gluyas, E. ...	26	17*	14	14	8	79

* Deduction, new land, 6 points.

I. THOMAS, Judge.

DOODLAKINE-BAANDEE DISTRICT.

Judging by the 16 entries which the secretary had secured, it was evident that he had succeeded in creating interest in the movement for increasing the prosperity of the district, and making it better known to the public.

Unfortunately seven of the competitors cancelled their entries. Two others were not judged in detail owing to the condition of the competing crops not reaching the standard set for these competitions.

The first place was gained by Messrs. Barton & Sons, who also were the winners last year. Mr. B. L. Murray was awarded second place with a crop giving the high yield of 36 bushels, or four bushels more than the winner; this crop failed to hold its advantage, however, mainly owing to

the presence of weeds which caused it to lose seven points. Both crops were planted on well-worked fallowed land and with somewhat similar treatment.

The winning crop was a late variety, Gluyas Late, planted in April, and the second was of Gluyas Early, planted a month later.

For comparison, the details regarding the treatment given these two and the other crops are set out in Table B (appended) :—

TABLE B.—SHOWING METHODS OF CULTIVATION.

Particulars.	Barton & Sons.	H. Rawlings.	B. L. Murray.	J. W. Spillman.
No. of Crops ...	8th.	5th.	10th.	7th.
Timber ...	Gimlet and Salmon.	Gimlet and Salmon.	Gimlet and Salmon.	Gimlet and Salmon.
Ploughed ...	July.	June.	July.	July.
Depth	4 inch.	4 inch.	4½ inch.	4 inch.
Plough ...	Disc, Cultivator.	Mould-Board.	Mould-Board.	Disc.
Condition at Ploughing Time	Good.	Good.	Good.	On wet side.
Other Cultivation	Cultivated (Springtyne) Sept., Feb., and April, prior to seeding.	Skim ploughed in September, Cultivated prior to seeding.	Cultivated (skim-disc) in September, Cultivated (Springtyne) in October, and cultivator attached to drill.	Cultivated twice in August, early December and again in December after rain, also prior to seeding.
Variety	Late Gluyas.	Nabawa.	Gluyas Early.	Merredin.
Planted	2nd week April.	2nd week April.	Middle May.	1st week May.
Rate of Seed ...	57lbs.	50lbs.	60lbs.	60lbs.
Treated ...	Dry.	No.	Bluestone.	Bluestone.
Graded	Yes.	No.	No.	No.
Super	80lbs.	80lbs.	72lbs.	90lbs.

Particulars.	H. Reid.	McGregor Bros.	Prowse Bros.
No. of Crops ...	10th.	6th.	17th.
Timber ...	Gimlet and Salmon.	Gimlet and Salmon.	Gimlet and Salmon.
Ploughed ...	July-August.	July.	July.
Depth ...	4 inch.	4½inch.	4½inch.
Plough ...	Disc.	Mould-Board.	Mould-Board.
Condition at Ploughing Time	On wet side.	Good.	Good.
Other Cultivation	Cultivated after ploughing, skim ploughed prior to seeding.	Cultivated (Sundercut) in Sept. Cultivated, harrowed and rolled before drilling.	Cultivated twice in spring, and planted with Combine.
Variety	Late Gluyas.	Nabawa.	Nabawa.
Planted ...	End April.	1st week May.	Middle May.
Rate of Seed ...	45lbs.	60lbs.	45lbs.
Treated ...	Dry.	No.	No.
Graded ...	No.	Yes.	Re-cleaned.
Super ...	65lbs.	70lbs.	72lbs.

It will be noticed that the progressive farmers are agreed upon the necessity for ploughing in the winter and cultivating in the spring and just before seeding.

The rate of seeding varies from 45 to 60 lbs. per acre, and the time of sowing from the middle of April to middle of May.

The treatment of seed for smut is not general, though the majority have practised it; two of them adopting the up-to-date dry method.

In one instance when this method was adopted a little bunt was found. In view of the very satisfactory results obtained with this treatment, this is difficult to understand unless too small a quantity was used, or insufficient mixing.

Grading the seed—as in some other districts—is not as general as it should be.

Following up the usual practice, Messrs. Barton & Sons, and Mr. B. L. Murray, the winners of this competition, will represent this district in the Royal Agricultural Society's Championship Crop Competition in Zone 1.

DOODLAKINE-BAANDEE DISTRICT AGRICULTURAL SOCIETY—1924.

Name and Address.	Variety.	Yield.	Freedom from Weeds.	Freedom from Disease.	Freedom from Admixture.	Evenness of Growth.	Total.
	Points ...	35	25	15	15	10	100
Barton & Sons, North Baandee	Gluyas L. ...	32	23	14	13	9	91
Murray, B. L., Doodlakine ...	Gluyas E. ...	35	18	13	12	8	86
Rawling, H., North Baandee	Nabawa ...	30	20	13	14	8	85
Reid, H., North Baandee ...	Gluyas L. ...	30	22	11	12	9	84
Spillman, J. W., Nth. Baandee	Merredin ...	30	20	13	12	9	84
Macgregor Bros., Doodlakine	Nabawa ...	28	18	13	12	8	79
Prowse Bros., Doodlakine ...	Nabawa ...	26	18	13	12	8	77

I. THOMAS, Judge.

KELLERBERRIN.

It was disappointing to find that in such an old and well-known district, which has always given a lead in progressive agricultural methods, so little interest was taken in this movement that there were only three competitors, namely, Messrs. Frank Mather, Jas. McLellan, and J. Deane Hammond. Two other entres were received but were cancelled before the date of inspection.

The winning crop of 50 acres was part of 280 acres, and was the eighth crop. It was sown on well prepared fallow which had been ploughed (mould-board) 4 inches deep during June, 1923. This land was cultivated with a Springtyne cultivator in August, September, and October of the same year, and again in April of the following year. It was sown with a combined cultivator drill late in May and early in June. The ground was harrowed after planting.

The second prize crop was also fallowed in June and July, 1923, and at this time the land was inclined to be boggy, and in consequence became hard and lumpy after ploughing. It was then broken down with a disc implement as the Springtyne cultivator was not suitable. In September this land was further cultivated with the Springtyne cultivator, and again prior to seeding, which took place in April, it was cultivated and rolled. This crop, unlike the winning crop, did not stand the checks which it received through the dry spells experienced during July and September. This is believed to be due to the want of "heart," owing to the ploughing which took place whilst the ground was boggy. On both crops 60 lbs. of graded seed per acre had been sown, with an application of superphosphate at the rate of 90 lbs.

and 80 lbs. respectively. That of Mr. J. D. Hammond was treated with carbonate of copper, whilst the other was not treated. Owing to the absence of Mr. Mather, no particulars regarding the cultivation for this crop could be obtained.

The winning crop was very even, whilst the other two were irregular; and, in the case of Mr. Mather, strips had been missed when drilling. There were also a few strips of another variety sown, which considerably reduced the points given for freedom from admixture.

During July and September, very dry spells were experienced, yet despite these the very satisfactory yield of 34 bushels was obtained, and this is evidently due to and a triumph for correct and thorough methods of cultivation.

KELLERBERRIN AGRICULTURAL SOCIETY—1924.

Name and Address.	Variety.	Yield.	Freedom from Weeds.	Freedom from Disease.	Freedom from Admixture.	Evenness of Growth.	Total.
	Points ...	35	25	15	15	10	100
Hammond, J. D., Kellerberrin	Nabawa ...	34	23	13	14	9	93
McLellan, J., Mt. Stirling ...	Nabawa ...	24	20	13	12	8	77
Maher, F., Kellerberrin ...	Nabawa ...	27	22	12	6	8	75

I. THOMAS, Judge.

ROYAL AGRICULTURAL SOCIETY.

*McLean, J., County Peak, Beverley	Nabawa ...	35	20	13	14	8	90
†Hebiton, J. K., Three Springs	Gresley ...	31	23	13	12	9	88
†Carter & Son, Three Springs	Niloc ...	35	20	11	11	8	85
†Lukin, G., Calcarra	Major ...	34	18*	12	12	9	85
†Vanzetti, Mrs., Marchagee ...	Nabawa ...	23	21	13	13	6	76
*Locke, J. H., Pithara ...	Nabawa ...	21	17	13	13	7	71

* Deductions: 2 points third crop.

*I. THOMAS.

†W. P. CASS-SMITH, B.Sc., Agric.

NUNGARIN AGRICULTURAL SOCIETY.

Four crops were entered in this competition; they were all good, with very little difference between them.

The first was of "Gluyas Early," belonging to Mr. Creagh. It was very even in growth and very free from weeds and admixture, an odd plant of barley being the only thing that detracted from its appearance. This was sown the first week in May, 40 lbs. seed and 70 lbs. super. being used.

The second crop was also "Gluyas Early," belonging to Mr. F. Warner, and was similar in many respects to Mr. Creagh's crop. It contained some mustard and wild oats, but was very free from admixture. It had gone down rather badly in some places, which detracted somewhat from its appearance. This crop was sown the third week in April with 48 lbs. seed and 75 lbs. super.

The third crop was "Nabawa," belonging to Mr. Johnson. It was sown in early May with 55 lbs. seed and 60 lbs. super. This contained some mustard and some undergrowth, and was rather uneven owing to some rocks and a watercourse, but it was very free from admixture and disease.

The next crop was "Gresley," belonging to Mr. Stagg. This was rather uneven in growth and contained a fair percentage of ball smut, also a few plants of flying smut and an odd plant of flag smut. There were a few weeds in places.

Details of the awards are shown in attached table:—

CROP COMPETITION.

NUNGARIN DISTRICT AGRICULTURAL SOCIETY.

Competitor.	Address.	Variety.	Yield.	Freedom from weeds.	Freedom from Disease.	Freedom from Admixture.	Evenness of growth.	Total.
		Possible Points	35	25	15	15	10	100
Creagh Bros. ...	Nungarin ...	Gluyas Early	29	22	14	13	9	87
Warner, F. ...	Nungarin ...	Gluyas Early	28	20	14	13	8	83
Johnson, Mr. ...	Nungarin ...	Nabawa ...	28	21	14	13	6	82
Stagg, Mr. ...	Nungarin ...	Gresley ...	24	21	11	12	6	74

Judge: J. LANGFIELD.

MERREDIN AGRICULTURAL SOCIETY, 1924.

This year there were 13 competitors for this competition, the first and second being eligible for the Royal Agricultural Society's Cropping Competition.

The winning crop was that of Mr. G. Woolgar, of Goomarin, and the variety was "Nabawa." This was seeded at the rate of 42 lbs. per acre with 100 lbs. of super., and was sown the second week in May. It was very well developed, being on Jam and Salmon Gum country, which holds the moisture better than the Gimlet country. It was fairly even but contained a small percentage of wild oats, but not sufficient to in any way interfere with the yield.

The second crop was Messrs. Teasdale Bros., of "Cumberland Farm," Belka, and the variety was "Merredin." This was an even and well-grown crop, but it contained a few small patches of "Take-all"; the paddock also contained a couple of depressions, and the crop was somewhat lighter in these. There was a trace of Flag Smut in places, but this was on the flag only and the plant was not injured. In the low places there were also a few blighted ears.

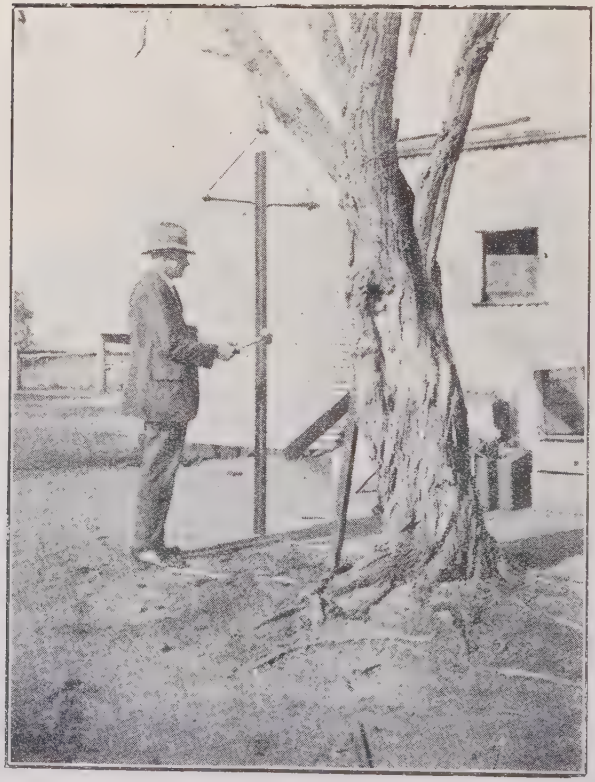
Points were awarded as shown in the table hereunder:—

CROP COMPETITION.

MERREDIN DISTRICT AGRICULTURAL SOCIETY.

Competitor.	Variety.	Yield.	Freedom from Weeds.	Freedom from Disease.	Freedom from Admixture.	Evenness of Growth.	Total.
Possible Points ...		35	25	15	15	10	100
Woolgar, W. G.	Nabawa	35	22	13	14	8	92
Teasdale Bros. ...	Merredin	35	23	12	13	8	91
Dumsday, G. ...	Nabawa	34	23	14	11	8	90
Harling Bros. ...	Nabawa	32	22	13	14	8	89
Wagner, C. ...	Gresley	34	22	11	12	8	87
Pollock, R. ...	Gluyas Early ...	34	19	11	14	9	87
Walker, H. ...	Gluyas Early ...	32	21	12	14	7	86
Teasdale, H. W.	Newman's Early ...	31	20	13	12	8	84
Priestley, J. P. ...	Nabawa	28	21	13	13	8	83
McConnell, E. J.	Nabawa	27	23	9	13	7	79
Clothier, J. ...	Metredin	25	21	13	13	7	79
Kay, J.	Nabawa	26	20	12	13	8	79
Brown, C. L. ...	Nabawa	26	22	13	11	7	79

JUDGE—MR. J. LANGFIELD.



CEREAL SMUTS.

(Continued from page 19.)

W. M. Carne, F.L.S.,
Botanist and Plant Pathologist.

OAT SMUTS.

(*Ustilago levis* and *Ustilago avenae.*)

Two smut diseases of oats occur in this State as in other oat-growing countries. Though caused by distinct fungi, the resemblance between the two is so close that they may be and are regarded by the farmer as one. The distinctions, even under microscopic examination, are not always readily seen, and even scientific workers have confused them. There are, however, certain field differences which in most cases leave little doubt as to which of the parasitic fungi are responsible in each case. With *Ustilago avenae* or *loose smut* more or less of the chaff as well as the grains are converted into the powdery black smut, which is finally blown away leaving only the bare branches of the head. With *Ustilago levis* or *covered smut* the chaff is little or not affected, and the smut masses do not so readily break up and blow away. Covered smut appears to be the more common in this State.

Symptoms.—As already stated the grains, and in loose smut the surrounding chaff, are converted into black powdery masses. (Fig. 1.) Smut develops early in the formation of the heads and may be noted even before they get free from the boots or enveloping leafsheaths. Usually all the grains on a head are infected, but occasionally the smut is confined to the lower, the upper grains developing normally. By harvest time (for grain) the bulk of the smut has been blown away, leaving only bare stalks and the remains of the chaffy grain coverings.

Loss due to Smut.—As compared with bunt or ball smut of wheat, oat smut is a much less serious disease. At the same time losses are frequently much more important than is realised, as an estimate of the percentage of infection can only be reliably made at flowering time. At harvest many of the smutted plants may be overlooked owing to the smut having blown away. The disease is commonly present in all oat crops, but the infection probably does not exceed 5 per cent. in the majority of cases. Losses, however, up to 25 per cent. or more may occur. The importance of the disease lies in the direct loss of grain. The sound grain harvested is not deteriorated commercially. There is no objectionable odour or visible evidence of the presence of smut. A minor loss from the point of view of hay may result from the fact that smutted plants tend to head early and to be somewhat shorter than sound plants. There is also a loss of food value through the destruction of the grain.

Life History.—As in bunt or ball smut of wheat, the smut consists of spores (chlamydospores) or fungoid seed bodies. Infection also takes place only in the early seedling stage up to the appearance of the first green leaf. Exactly how it is brought about is somewhat uncertain. To some extent it may be from spores on the outside of the grains, but it is more likely that the greater amount is due to spores which are blown at flowering time into open flowers of the normal plants. These spores are caught inside the hulls, and with the growth of the grain and the adherence to it of the hulls are firmly enclosed. When the grain is sown the spores germinate, producing germ tubes which enter the young seedling and develop into the parasitic stage of the fungus. As the plant grows the fungus grows with it, and finally, when the flowers are formed, enters them and converts them into smut masses.

Fig. 1. Smut of Oats.
(After McAlpine.)

In experiments dusting the grains of ordinary hulled oats does not give the infection secured with similar treatment of wheat with bunt spores. With skinless oats, or oats which have been artificially dehulled, infection takes place readily.

Treatment.—Clean crops will produce clean seed. Such crops are, however, rare. It is advisable to regard all oats as more or less smutted. Infection taking place from spores on or caught within the hulls of the grain, it is possible by seed treatment to prevent these spores bringing about infection. In general, farmers take no precautions but put up with an avoidable loss. Formalin is recommended for seed treatment, but where a farmer is using copper carbonate for wheat he will probably prefer to use it for oats also. The dry treatment is not as effective as formalin, probably owing to it being less able to penetrate the hulls. However, experimental results indicate that it gives a reasonable control and considerably reduces the percentage of smut. At the same time it is free from the objectionable action of formalin on germination, and may be used on the seed long before sowing.

For those who prefer formalin there are several methods of using it. The following is advised in preference to dipping in a solution, as the grain is more readily dried sufficiently to run through the drill:—

Place the grain in a heap on a tarpaulin or clean flour. Sprinkle with a formalin solution, made by adding one pint of formalin to about 35 gallons of water, using about one gallon to a bushel of grain. The solution may be sprinkled from an ordinary watering can. As it is applied the grain should be shovelled from one heap to another until all is wetted. When finished, cover the grain with bags wetted with the formalin solution for six to eight hours. Then spread the grain out to dry. Sowing should take place soon after the treatment of the grain before it becomes quite dry, or the germination may be detrimentally affected.

If the dry treatment is adopted, two to three ounces of copper carbonate should be used to the bushel, taking care that the seed is thoroughly dusted.

COVERED SMUT OF BARLEY.

(*Ustilago hordei.*)

Covered smut of barley is not uncommon in Western Australia, but rarely occurs in sufficient quantity to receive any attention from farmers, as barley is not one of our important grain crops. It is frequently confused with Loose Smut. Covered smut may be recognised by the black smutty spore masses, which persist until harvest. The whole of the affected heads are involved, the grains and their coverings being replaced by the mass of dark purplish black spores at first covered by a thin membrane. (Fig. 2.) Some of the smut masses may be blown away, but usually a number persist and are harvested with the grain.

The life history appears to be similar to that of oat smut, infection taking place on the young seedling, but unfortunately the fungus does not respond so readily to seed treatment.

Formalin has been generally recommended but does not give absolute control, and its good effects are somewhat negatived by its detrimental action on the seed. Copper carbonate has not proved to be effective to any extent. At present, unless smut is very bad, seed treatment with these preparations is not advised. In Europe and North America wet treatments with organic mercury compounds such as Chlorophol and Semesan are giving promising

Fig. 2. Covered Smut of Barley.
(After McAlpine.)

results in experiments, but these compounds are not available to farmers here. The use of grain from affected crops should be avoided if possible. This applies also to barley threshed too closely so that portions of the seed coverings are torn away. Such seed is very liable to smut infection and bad germination. Clean crops will give clean seed, but such crops are rare.

Fig. 3. Loose Smut of Wheat.

LOOSE OR FLYING SMUT OF WHEAT.

(*Ustilago tritici.*)

Loose smut is common in our wheat areas. The whole of an affected head, both grain and chaff, is converted into a loose black mass of dusty spores at about the time healthy wheat is flowering. (Fig. 3.) By harvest the smutty

spores have been blown away, leaving only bare stalks. In consequence the amount of loss is often overlooked or assumed to be much less than in reality.

Loss.—The loss of grain is the only important effect of this disease. There is no objectionable odour as with bunt, and consequently the commercial value of the grain crop harvested is not affected. The disease does not spread as rapidly as bunt, and is of much less importance economically. Nevertheless the losses are at times considerable.

Life History.—Unlike bunt and oat smuts, infection takes place at flowering time. The loose dusty smut spores (chlamydospores) are blown into the open flowers of the healthy wheat plants from those which are smutted. The spores fall upon the stigmas or sensitive portions of the embryo grains and germinate there. The spore tubes produced by them enter the young grains. These latter develop to all appearances quite normally. If planted the following season, however, the fungus which has lain dormant within them commences to grown again, and enters the young shoot, growing with it until it heads. It then enters the head and converts the grain and chaff into the mass of spores we know as smut.

Prevention.—As the fungus is within the seed it follows that the use of bluestone, formalin or copper carbonate cannot be effective. These preparations can only be used to kill smut fungi before they infest the seed. Once the seed is infested internally they are useless.

The treatment most readily available to the farmer is one of prevention. Crops free from smut and reasonably far enough from affected crops will produce clean seed. Freedom from smut can, however, only be told by examination at flowering time.

If a small seed plot is raised and all affected plants removed as soon as the smutted heads show, the grain produced will be clean. This involves regular and close work which is out of the question for most farmers. However, if seed is purchased from the State Experiment Farms the resulting crops will be found free from smut, as the system adopted at those institutions is such as to ensure clean crops.

One direct method of seed treatment is available where smut is bad, but is not advised for general use owing to the difficulties of its application. It is known as the modified Jensen hot water treatment, and is quite extensively used in the United States of America. Only sufficient grain for seed plots is treated, and the resultant crops are used for the main crops of the following year. The treatment consists of soaking the grain for 5-7 hours in water at ordinary temperatures, and then hot water for ten minutes. The hot water should be about 129° F. and must not fall below 124° or exceed 131° or the treatment will be ineffective or the grain badly affected. Fuller details may be had on application to this Department.

LOOSE SMUT OF BARLEY.

(*Ustilago nuda.*)

This disease occurs to a small extent in most barley crops, but as a rule receives little attention from farmers. As with covered smut, the affected heads are converted into masses of spores. It differs, however, in that the spores (smut) are dark brown, the spore masses break up about flowering time, and by harvest are all blown away, leaving only the bare stems.

It has long been believed that this smut affected the grain at flowering time in the same way as loose smut of wheat, and was so stated in the intro-

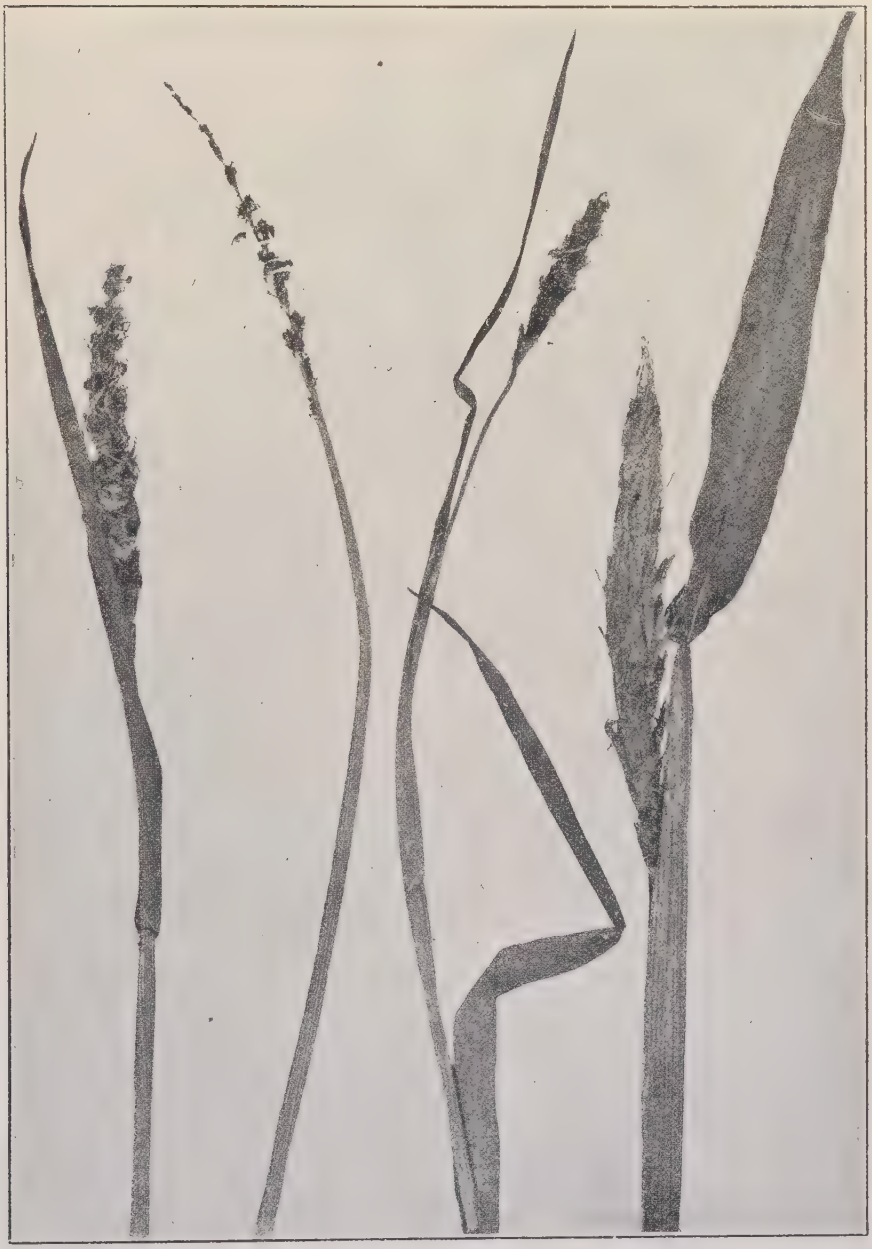


Fig. 4. Loose Smut of Barley.
(After McAlpine.)

duction to this article. Quite recently it has been found that a good deal if not all of the infection takes place on the seedling as in covered smut of barley, oat smut, and bunt of wheat.

Formalin, as recommended for oat smuts, gives a certain amount of control. Copper carbonate appears to be quite ineffective. Better results have been obtained in experiments in the United States of America with the organic mercury compounds mentioned under covered smut. At present seed treatment cannot be recommended except when smut is very bad, in which case formalin is advised. The use of grain from affected crops is not advisable if it can be avoided. Clean crops will give smut-free seed, but such crops are rare. Freedom from smut can only be determined at flowering time. It is too late at harvest time. Grain too closely threshed so that portion of the seed coverings are torn away should be avoided, as such seed is very liable to smut infection and bad germination.

SUMMARY.

The following are the smut diseases of cereals known to occur in this State, and the methods advised to control them:—

Flag Smut of Wheat.—Treat seed with copper carbonate as a precaution against infecting clean paddocks. Rotate with fallow, oats, or other crops. Use Nabawa when sowing wheat in a paddock previously affected.

Bunt or Ball Smut of Wheat.—Treat seed with copper carbonate dust unless it is known to come from clean crops.

Loose Smut of Wheat.—Use seed from clean crops. Seed from the State Experiment Farms is clean.

Loose and Covered Smuts of Oats.—Treat seed with formalin or copper carbonate (the former is preferred) unless it is known to come from clean crops.

Loose and Covered Smuts of Barley.—No treatment is advised unless smut is very bad, in which case formalin should be used. Clean crops will give clean seed.

FERTILISER EXPERIMENTS WITH POTATOES.

Farmers' Trials at Benger, 1925.

G. N. Lowe,

Senior Potato Inspector.

The fertiliser generally used for potatoes in the Benger swamp area has been superphosphate (18 per cent.) applied at the rate of 15 to 20 cwt. per acre. Recently some growers have, as the result of experience, decided that superphosphate alone is unsatisfactory, and that for best results it is necessary to add some form of nitrogenous fertiliser to the superphosphate. In consequence a potato manure containing 3.02 per cent. of nitrogen and 13 per cent. soluble phosphoric acid is being tried. There is some justification for this belief for the soil of the Benger swamp is covered with water, which starts to recede in spring, and becomes dry in January when the potato crop requires to be planted. Because the soil is under water throughout the winter, and there is a very limited time in which to prepare and till the soil before planting, the quantity of available nitrogen is likely to be limited, and therefore the application of a nitrogenous fertiliser appears to be justified.

The soil of the Benger swamp is a free working blue clay, physically well adapted for the cultivation of potatoes, and possibly, like other clays, contains sufficient potash for the immediate requirements of the crop. In planning the experiment it was, however, decided to obtain some information on this point. Most of our soils are regarded as deficient in phosphoric acid, and it is probable that the Benger soils in common with others are also deficient, but, despite this assumption, it is believed that the quantity of phosphoric acid supplied in the usual dressings of the two fertilisers referred to is altogether out of proportion to the needs of the soil or the crop.

With the kindly co-operation of Mr. C. L. Clarke, of Burekup and Benger, it was decided to carry out an experiment in the midst of his main potato crop in order to determine the composition of a well-balanced fertiliser best adapted for application to the potato in these soils. The plan adopted in this experiment has been to apply a complete fertiliser to a number of control plots, used as the basis of comparison, and then to ascertain—

(a) The effect of the absence of potash;

(b) The effect of reducing the quantity of nitrogen applied;

(c) The effect of reducing the quantity of soluble phosphoric acid;

(d) The effect of using nitrate of soda instead of sulphate of ammonia as a source of nitrogen.

It was intended also to use blood in this connection, but it was not procurable. In view of the past experience of the growers it was assumed that

both phosphoric acid and nitrogen were necessary constituents of any fertiliser for these soils.

As a matter of special interest to the Benger growers it was decided to include in the experiment a plot fertilised with the potato manure referred to, and with which other fertilisers could be compared. With this object in view the check or control plots were fertilised with a complete fertiliser which, in addition to potash, contained the same quantities of nitrogen and phosphoric acid as would be found in a liberal dressing of "Potato Manure." Each of the three different ingredients of plant food applied to the control plots was on a liberal scale. This was to ensure that the yield consequent upon a variation of the quantity of one of the ingredients would not be influenced by a deficiency of any of the other two.

The quantity of plant food applied to each plot, the fertiliser used to provide that plant food, and the order in which the plots were planted, may be seen from the following particulars:—

FERTILIZER EXPERIMENTS WITH POTATOES.

BENGER, 1925 (SUMMER CROP.)

Plot No.	Plant Food supplied per Acre.		Fertilizer used.	
		lbs.		lbs.
Plot 1 Control.	Nitrogen	100	Sulphate of Ammonia ...	500
	Phosphoric Acid	300	Super	1,430
	Potash	100	Sulphate of Potash ...	204
Plot 2	Nitrogen	70	Potato Manure	2,320
	Phosphoric Acid	300		
Plot 3	Nitrogen	70	Sulphate of Ammonia ...	350
	Phosphoric Acid	300	Super	1,430
	Potash	100	Sulphate of Potash ...	204
Plot 4	Nitrogen	40	Sulphate of Ammonia ...	200
	Phosphoric Acid	300	Super	1,430
	Potash	100	Sulphate of Potash ...	204
Plot 5 Control	Nitrogen	100	Sulphate of Ammonia	500
	Phosphoric Acid	300	Super	1,430
	Potash	100	Sulphate of Potash ...	204
Plot 6	Nitrogen	100	Sulphate of Ammonia ...	500
	Phosphoric Acid	200	Super	950
	Potash	100	Sulphate of Potash ...	204
Plot 7	Nitrogen	100	Sulphate of Ammonia ...	500
	Phosphoric Acid	100	Super	475
	Potash	100	Sulphate of Potash ...	204
Plot 8	Nitrogen	100	Sodium Nitrate	645
	Phosphoric Acid	300	Super	1,430
	Potash	100	Sulphate of Potash ...	204
Plot 9 Control	Nitrogen	100	Sulphate of Ammonia ...	500
	Phosphoric Acid	300	Super	1,430
	Potash	100	Sulphate of Potash ...	204

Because of the liberal application necessarily given to the control plots, and of the plant food applied to some of the plots solely to enable comparisons to be made, it is not practicable to draw conclusions as to the commercial value of the different mixtures used in this experiment. The benefits derived from it are due to the comparisons which can be obtained from the yields due to the different treatment given to the plots. In this connection it will be seen from the particulars given that the only difference between Plots 2 and 3 is that the second plot has received no potash; that Plots 3 and 4 have had applied to them respectively two-thirds and one-third the amount of nitrogen given to the control; that Plots 6 and 7 similarly have had respectively two-thirds and one-third the amount of phosphoric acid, and that Plot 8 has received the same amount of complete plant food as the control, but the nitrogen has been supplied by the quicker-acting nitrate of soda. From the differences thus stated the comparisons can be made.

The experiment was placed in the centre of the paddock in which the main crop was planted. The preparation of the soil and other cultural operations were therefore the same as those given to the main crop. Each plot consisted of one row ten chains long, and which extended almost across the paddock. The planting was done on 4th February, the variety was "Delaware"; whole sets were used, and were dropped at the rate of about 1,500 lbs. per acre.

The condition of the soil at planting time was ideal, and it is doubted if Benger swamp has ever, as a whole, been in better condition at this period. Unfortunately the season, from the standpoint of heavy yields, was most unfavourable, as practically no rains of value fell between planting and harvest time. The rainfall recorded at the nearest station, Brunswick, during the growing period was February 4, March 67, and April 50 points. Further, owing to dry weather, an outbreak of green aphis occurred just when the crop looked a veritable picture, and in consequence a most promising crop was reduced to about a third of the yield which might have been reasonally expected had the usual rains fallen, for this would have checked the aphis.

When planning the experiment it was anticipated that the main crop surrounding the experiment would be manured with "Potato Manure." It was, however, manured with superphosphate at the rate of 1,800 lbs. per acre. It was decided to take advantage of this alteration of plans, and to harvest for purposes of comparison two rows, one on each side of the experiment block. These two rows are indicated in the table of results by the letters "A" and "B." They were fertilised with superphosphate at the rate of 1,800 lbs. per acre, but in every other respect were treated identically with the experimental rows.

The plots were harvested on 6th and 7th May. For the purpose of ascertaining whether the yield from each row was consistent or not, each row was divided into four equal sections two and a-half chains long, and each section was harvested and weighed up separately. From the yields obtained from the different sections it will be noticed that the yield receded in each section consistently toward the fourth. This may be accounted for by the fact that the soil was not so moist toward the fourth section, or north end of the plot. The yields obtained are set out hereunder:—

FARMERS' TRIALS.

FERTILIZER EXPERIMENTS WITH POTATOES.

BENGER, 1925.

Variety—Delaware. Planted 4th Feb., 1925. Harvested 6th and 7th May, 1925. Seed per acre 1,500lbs.

Plot.	Fertilizer per Acre.	Yield. 1st. Section 1/100th of an acre.				2nd. Section 1/100th of an acre.				3rd. Section 1/100th of an acre.				4th. Section 1/100th of an acre.				Average.				Percentage Yield.
		T.	C.	Q.	L.	T.	C.	Q.	L.	T.	C.	Q.	L.	T.	C.	Q.	L.	T.	C.	Q.	L.	
A.	1,800lbs. Superphosphate *Control.*	3	17	2	20	3	16	3	4	2	17	0	16	2	10	0	0	3	5	1	17	89
1	500lbs. Sul. Ammonia 1,430lbs. Super. ... 204lbs. Sulphate Potash	3	15	3	16	4	0	1	12	4	1	1	0	3	0	2	24	3	14	2	6	100
2	2,400lbs. Potato Manure	4	3	0	4	3	15	3	16	3	11	1	20	3	0	2	24	3	12	3	2	97
3	350lbs. Sul. Ammonia 1,430lbs. Super. ... 204lbs. Sul. Potash	3	14	0	12	3	6	0	8	4	2	0	16	3	6	0	8	3	12	0	11	95
4	200lbs. Sul. Ammonia 1,430lbs. Super. ... 204lbs. Sul. Potash	3	16	3	4	4	3	0	4	3	18	2	8	3	6	0	8	3	16	0	13	100
	Control.																					
5	500lbs. Sul. Ammonia 1,430lbs. Super. ... 204lbs. Sul. Potash	4	11	3	24	4	5	2	24	3	11	1	20	2	18	0	4	3	16	3	4	100
6	500lbs. Sul. Ammonia 950lbs. Super. ... 204lbs. Sul. Potash	4	5	2	24	4	7	2	0	3	15	0	0	3	2	2	0	3	17	2	20	104
7	500lbs. Sul. Ammonia 475lbs. Super. ... 204lbs. Sul. Potash	4	3	3	20	4	3	0	4	3	11	1	20	2	13	2	8	3	13	3	27	100
8	645lbs. Sodium Nitrate 1,430lbs. Super. ... 204lbs. Sul. Potash	4	12	3	12	4	9	1	4	3	15	3	16	3	2	2	0	4	0	0	15	112
	Control.																					
9	500lbs. Sul. Ammonia 1,430lbs. Super. ... 204lbs. Sul. Potash	4	0	1	12	3	15	0	0	3	8	3	0	2	15	1	12	3	9	3	13	100
B.	1,800lbs super.	3	6	0	8	2	15	1	12	3	6	3	24	2	13	2	8	3	0	1	27	89

Because of the liberal rate at which the plots were fertilised to facilitate comparisons of yields, it is not practicable to make comparisons of the relative money values of the different fertilisers applied to the respective plots nor can definite conclusions regarding the causes which have influenced the yields be drawn from the results obtained, as the experiment has been conducted for one year only, and this has been an unusually dry one. Interesting comparisons can, however, be made and tentative inferences drawn from them.

On examining the percentage results which are the most suitable for comparisons, it is found that the difference between the results from the plots with and without potash is so slight as to indicate that potash is not a necessary constituent of a fertiliser in order to secure a crop like that obtained on this occasion. The results obtained from the plots receiving the varying amounts of soluble phosphoric acid are also so similar as to indicate that the maximum amount applied on this occasion is much in excess of requirements, and that the usual application of 15 cwt. of superphosphate per acre is wasteful.

It would also appear from a comparison of the yields of Plots 3 and 4 with those of the control plots that, in a dry season like the past, the lighter dressings of sulphate of ammonia are as effective as the heavier ones, but the differences between the return from the plots which have received a nitro-

genous dressing are so consistently greater than those from the Plots A and B, which received no nitrogen, and which also received no potash, but which is apparently not needed, that they strongly support the view that nitrogenous fertilisers are necessary for best results on these soils.

Additional support in this direction is afforded by the increase of 12 per cent. resulting from the use of the quick-acting nitrate of soda, when applied instead of the slower-acting sulphate of ammonia.

The most striking feature of this experiment is the apparent indication of the scarcity of available nitrogen in this soil. This is not very surprising, seeing that it is submerged six months of the year, and that in consequence, nitrification can be active only for a limited period. Under such circumstances the obvious lesson is, that to economise in the purchase of expensive fertilisers, it is essential to commence the preparation of the soil at the earliest date possible, and further to give the crop the maximum amount of inter-tillage so as to stimulate the process of nitrification to the fullest extent.

That such a practice would be beneficial is rather supported by the experience of two growers, Messrs. Gibbs Brothers, who latterly have made a practice of fallowing at least a portion of their block immediately after the planting period has ended in January, and leaving it unplanted until the next season. Although this fallowed land is submerged during the following winter, it has been found that the growth of the crop is so improved that the position of the fallowed portion can be determined to the row by the appearance of the crop.

DAIRY HERD IMPROVEMENT.

P. G. HAMPSHIRE,
Dairy Expert.

Following upon the Department's policy of urging the use of registered pure sires ex dams with official butter fat production of such merit as will enable the progeny of these cows to be the means of improving the progeny of the average production cows of the State, the following is a list of all standard cows which have been officially tested to date. When the scheme for dividing the State into zones for the use of registered pure bulls ex these proved production cows was launched, it was noted the success of such a scheme would depend upon continuity of policy, and following on the use of the male progeny of standard cows it is confidently expected that material advance will be made in the production of the average cow in each of the zones through their progeny.

The Government has laid down that the only bulls that will be purchased for distribution to group settlers and others must be the progeny of cows with a production record above the standard decided upon. The information shown in this and the last issue of the *Journal* gives the name of owner, name of cow, breed, herd book number, weight of milk for period, average test, total butter-fat and standard required—lbs. of fat. In confirmation of circular issued on 29th May, 1924, the standard of production over a period of 273 days' test is 166 lbs. fat (or 200 lbs. commercial butter) in the case of a heifer on first calf, 207 lbs. fat (or 250 lbs. commercial butter) in the case of a cow under four years, and 249 lbs. fat (or 300 lbs. commercial butter) in the case of a mature cow.

Concluded list of registered pure cows which have been officially tested and exceed the required production, enabling their male progeny to be eligible for purchase by the Government with a view of improving the dairy herds of Western Australia.

Name of Cow.	Owner.	Breed.	Herd Book No.	Weight of Milk for Period.	Average Test.	Total Butter Fat.	Standard required (lbs. fat.)
				lbs.	%	lbs.	
Carnation of Dardanup... ...	R. H. Rose ...	Jersey	9995	10,788	5·57	600·99	
Mokine Lady Guildford III. ...	T. H. Wilding	do. ...	10634	9,265	6·25	579·23	
Yarraview Bonnie Annie ...	A. W. Padbury	Guernsey	564	8,127	6·11	496·63	
Lily II. of Dardanup	R. H. Rose ...	Jersey ...	8946	9,345	5·24	489·90	
Jessie of Dardanup	do. ...	do. ...	8945	9,320	5·14	479·25	
Retford Buttercup II.	D. J. Goyder...	do. ...	6830	6,535	6·87	449·52	
Daisy of Grass Vale	R. H. Rose ...	do. ...	8473	7,615	5·56	423·83	
Fancy of Ventonia	T. L. Rose ...	do. ...	8648	7,782	5·35	416·78	
Mokine Dianthus	Walker & Co.	do. ...	8483	7,153	5·73	410·34	
Beauty 3rds Wangara of Pine Hill	R. H. Rose ...	do. ...	6134	9,214	4·44	409·54	
Veronica of Tarnpirr	D. J. Goyder ...	do. ...	5174	8,121	4·87	395·70	
Madge of Dalebank	D. Malcolm ...	do. ...	4759	6,985	5·59	390·44	
Lily II. of Dardanup	R. H. Rose ...	do. ...	8946	7,933	4·92	390·16	
Fancy of Liryclea	A. H. Henning	do. ...	6674	7,582	5·10	387·19	249
Romany Maid of Tarnpirr ...	P. Rose ...	do. ...	6036	6,823	5·66	386·24	
Silver Bell of Roelands ...	A. H. Henning	do. ...	10047	7,911	4·82	386·01	
Obligato	D. J. Goyder...	do. ...	4964	7,641	4·99	381·58	
Retford Violet	W. Padbury ...	do. ...	6938	6,528	5·78	378·08	
Rhodesia of Ventonia	T. L. Rose ...	do. ...	8469	6,884	5·33	366·86	
Lady of Inglewood	D. Malcolm ...	do. ...	5910	6,111	5·89	360·11	
Fondant 9th of Barden Hill ...	W. Padbury ...	do. ...	8456	6,801	5·23	355·84	
Mokine Columbine	T. H. Wilding...	do. ...	10043	5,881	5·94	349·85	
Rhodesia 5th of Penryn ...	T. L. Rose ...	do. ...	8470	7,272	4·77	347·35	
Lux of Yarralla	D. J. Goyder	do. ...	6825	7,143	4·66	333·50	
Lady Betty II. of Koogan ...	A. W. Padbury	Guernsey	872	7,685	4·33	332·99	
Lady of Inglewood	D. Malcolm ...	Jersey	5910	5,898	5·62	331·46	
Creamy of Dardanup	R. H. Rose ...	do. ...	8941	6,197	4·99	309·44	
Yarraview Isabel	A. W. Padbury	Guernsey	397	6,238	4·77	297·86	

Name of Cow.	Owner.	Breed.	Herd Book No.	Weight of Milk for Period.	Average Test.	Total Butter Fat.	Standard required (lbs. fat.)
				lbs.	%	lbs.	
Lady Fowler II. of Dardanup...	R. H. Rose ...	Jersey ...	10003	6,252	4·65	290·63	
Antimony's Elvira	T. L. Rose ...	do. ...	8465	5,142	5·61	288·67	
Mokine Picotee	Walker & Co.	do. ...	8486	5,135	5·61	288·55	
Jessiemia XI. of King's Vale ...	D. Malcolm ...	do. ...	6339	6,510	4·36	284·14	
Purity of Gowrie Park ...	W. G. Burgess	Ayrshire	4915	6,463	4·25	274·95	
Golden Gem of Dardanup ...	D. J. Goyder ...	Jersey ...	9988	6,120	4·39	267·94	
Belverdere 5th of Dardanup ...	P. Rose ...	do. ...	8925	5,797	4·59	266·31	
Lady Fowler 9th of Dardanup ...	T. L. Rose ...	do. ...	10008	9,838	4·98	489·95	
Flavoria of Banyule	Dept. of Agriculture	do. ...	8489	7,908	5·92	468·55	249
Girlie of Sarnia	D. Malcolm ...	do. ...	9992	9,180	4·85	446·01	
Lydia 5th of Yarralla	D. J. Goyder...	do. ...	6826	7,044	5·08	357·77	
Milton's Rosebud	A. W. Padbury	Guernsey	500	7,255	4·72	342·89	
Ice Cream of Glen Iris ...	W. Padbury ...	Jersey ...	7110	5,978	5·00	299·32	
Mokine Woodbine	T. H. Wilding	do. ...	8487	6,277	5·95	373·76	
Twylish Madeira of Roelands ...	D. Malcolm ...	do. ...	6832	5,356	5·77	309·08	
Tipperary Winsome	W. G. Burgess	Ayrshire	6166	6,441	4·67	301·42	
Boronia of Grass Vale	R. H. Rose ...	Jersey ...	9994	8,091	5·06	410·11	
Mokine Lady Noble	Walker & Co.	do. ...	10633	6,190	5·88	364·27	
Mokine Fancy	T. H. Wilding	do. ...	8484	5,337	5·99	319·13	
Yarraview Georgina	A. W. Padbury	Guernsey	782	5,763	5·24	297·04	
Rena II. of Gleneira	W. G. Burges	Ayrshire	8519	5,653	5·09	288·13	207
Mokine Malmaison	Walker & Co.	Jersey	11724	5,985	6·92	414·70	
Rhodora II. of Dalebank ...	D. Malcolm ...	do. ...	8451	6,286	5·79	364·01	
Daisy of Garden Hill	W. Padbury ...	do. ...	1628	5,785	6·18	357·95	
Mamselle Mimi of Hamel Lea...	A. H. Henning	do. ...	10046	5,166	5·37	277·85	
Mokine Empire's Lily V. ...	T. H. Wilding	do. ...	10635	5,725	6·67	382·09	
Annetta 3rd of Woollongbar ...	W.A. Government	Guernsey	589	4,963	1·05	300·39	
Gem of Moorlands	P. Rose ...	Jersey ...	8937	5,161	4·86	251·17	
Dairymaid 6th of Gleneira ...	W. G. Burgess	Ayshire	8513	5,770	4·12	238·05	
Virginia of Nundorah	A. W. Padbury	Guernsey	778	3,941	5·34	210·56	
Thelma of Blackheath	H. O. Timms ...	M.S. ...	12847	5,063	4·03	204·50	
Lady Fowler 14th of Dardanup	R. H. Rose ...	Jersey ...	12093	7,220	5·38	388·37	
Lady Fowler 17th of Dardanup	do. ...	do. ...	11695	5,766	5·75	331·64	
Lady Fowler 13th of Dardanup	D. Malcolm ...	do. ...	9986	7,036	4·43	312·15	166
Dunalister Manakin's Peree's Capture II.	R. H. Rose ...	do. ...	10392	4,730	5·99	283·76	
Alice of Blackheath	Wooroloo Sanatorium	M.S. ...	N.Y.A.	6,616	4·29	264·66	
Lady Fowler 18th of Dardanup	T. L. Rose ...	Jersey ...	12830	4,650	5·58	259·90	
Mokine Noble Lily	Walker & Co.	do. ...	11795	4,872	4·99	243·22	
Beauty of Sarnia	D. Malcolm ...	do. ...	12086	3,860	5·91	228·29	
Fancy's Pride of Ventonia ...	T. L. Rose ...	do. ...	12829	4,417	5·03	223·47	
Lily of Roelands	D. J. Goyder ...	do. ...	10619	4,881	4·43	216·64	
Jessimia of Sarnia	D. Malcolm ...	do. ...	12088	4,293	4·67	200·64	
Campaniles Maid of Garden Hill	R. H. Rose ...	do. ...	8935	9,235	5·53	511·18	
Lady Fowler 4th of Dardanup ...	D. J. Goyder ...	do. ...	10004	7,846	5·42	425·72	
Wild Rose II. of Garden Hill...	W. Padbury ...	do. ...	10091	6,534	5·77	377·03	
Noreen 5th of Garden Hill ...	do. ...	do. ...	7125	5,713	6·07	346·96	
Ettie IV.	do. ...	do. ...	2889	7,683	4·44	341·43	
Cheerful II. of Yarralla ...	A. H. Henning	do. ...	6258	5,799	5·57	323·29	
Gladness of Woollongbar ...	Department of Agriculture	Guernsey	452	5,967	4·88	291·45	249
Milton's Syringa	A. W. Padbury	do. ...	503	6,465	6·22	402·07	
Lady Fowler 7th of Dardanup ...	T. L. Rose ...	Jersey ...	10006	7,188	5·11	367·73	
Daisy Vale of Grass Vale ...	R. H. Rose ...	do. ...	8474	8,143	5·71	465·45	
Lady Fowler 10th of Dardanup	do. ...	do. ...	10009	6,297	5·12	322·62	
Rocket of Woollongbar ...	Department of Agriculture	Guernsey	541	6,018	4·85	291·89	
Treasure III. of Homeleigh ...	D. Malcolm ...	M.S. ...	N.Y.A.	8,829	4·68	413·77	
Lily of Grass Vale	R. H. Rose ...	Jersey	8497	8,772	5·03	442·87	
Morden Lady of Koogan ...	A. W. Padbury	Guernsey	722	10,296	3·78	389·41	
Lady Fowler 12th of Dardanup	R. H. Rose ...	Jersey	10011	8,065	4·81	388·15	207
Rhodora II. of Dalebank ...	D. Malcolm ...	do. ...	8451	6,286	5·79	364·01	
Madge II. of Dalebank ...	do. ...	do. ...	8449	5,180	6·36	329·80	
Velvet of Woollongbar	Department of Agriculture	Guernsey	774	5,703	4·25	242·79	
Lady Fowler 15th of Dardanup	T. L. Rose ...	Jersey	10010	6,996	5·76	403·42	
Sheila of Sarnia	D. Malcolm ...	do. ...	8452	5,392	6·21	334·99	
Gladness II. of Wollongbar ...	Department of Agriculture	Guernsey	631	4,299	5·77	248·39	
Mokine Empire's Lily 7th ...	T. H. Wilding	Jersey	11794	6,755	5·74	388·31	166
Wild Rose III. of Garden Hill ...	W. Padbury ...	do. ...	N.Y.A.	5,077	5·52	280·34	
Queen of Sarnia	D. Malcolm ...	do. ...	12091	4,173	4·92	205·37	
Carnation III. of Greyleigh ...	do. ...	M.S. ...	N.Y.A.	5,600	3·49	195·51	
Picton's Trequean Flirt ...	A. W. Padbury	Guernsey	747	9,093	4·94	449·81	207
Milton's Daisy II.	do. ...	do. ...	922	6,976	5·39	376·19	207
Lady Betty II. of Koogan ...	do. ...	do. ...	872	7,728	4·29	330·07	249
Yarraview Bonnie Annie ...	do. ...	do. ...	574	8,656	6·39	553·53	249
Virginia of Nundorah	do. ...	do. ...	778	5,713	5·45	312·37	207

Name of Cow.	Owner.	Breed.	Herd Book No.	Weight of Milk for Period.	Average Test.	Total Butter Fat.	Standard required (lbs. fat.)
				lbs.	%	lbs.	
Colleen of Rosewood	A. W. Padbury	Guernsey	819	5,673	5·61	318·40	166
Mokine Clove Carnation ...	Walker & Co.	Jersey	11796	4,779	6·70	320·52	166
Nymphea of Juadine	do. ...	do. ...	12081	4,444	5·87	261·15	166
Mokine Picotee	do. ...	do. ...	8486	5,436	5·90	321·02	249
Mokine Noble Lily	do. ...	do. ...	11795	6,367	4·85	308·74	207
Golden Pearl 4th of Wollongbar	W.A. Government	Guernsey	863	6,882	5·60	385·79	166
Silver Bell of Roelands ...	A. H. Henning	Jersey	10047	8,397	4·82	405·14	249
Fancy of Liryclea	do. ...	do. ...	6674	9,114	4·83	437·40	249
Bolebek Frieda	A. L. B. Lefroy	Fresian	1116	8,664	3·50	303·79	249
Bolebek Roma	do. ...	do. ...	1124	8,268	3·75	310·91	207
Lady Fobes Veeman	do. ...	do. ...	620852 U.S.A.	16,533	3·17	524·88	249
Bolebek Dulcena	do. ...	do. ...	1120	8,475	3·62	307·16	207
Bolebek Dorothea	do. ...	do. ...	293	7,306	3·78	276·88	249
Bolebek Judith	do. ...	do. ...	291	14,164	3·16	448·72	249
Netherland Colanthe Princess of Lydholme	do. ...	do. ...	932	7,200	3·69	266·28	166
Bolebek Joy	do. ...	do. ...	1117	9,840	3·79	373·26	249
Netherland Johanna of Lydholme	do. ...	do. ...	1355	8,055	3·69	295·35	166
Handsome Girl of Calcamine ...	G. C. Spencer	Jersey	10061	3,615	6·55	207·51	207
Blossom of Calcamine	do. ...	do. ...	10058	4,465	5·44	243·19	166
Lonesome of Calcamine ...	do. ...	do. ...	13439	3,808	5·82	221·86	166
Madge of Sarnia	D. Malcolm ...	do. ...	13437	5,863	5·74	336·97	166
Myrtle XII., Greyleigh	do. ...	I.M.S. ...	N.Y.A.	4,557	4·04	184·49	166
Lady Fowler XIII. of Dardanup	do. ...	Jersey	8986	7.981	5·53	441·27	207
Girlie of Sarnia	do. ...	do. ...	9992	10,039	5·11	513·12	249
Maranora of Tellaraga	R. H. Rose ...	do. ...	6707	11,509	5·04	580·48	249
Fairy of Dardanup	do. ...	do. ...	8942	11,235	4·80	539·41	249
Jean II. of Grass Vale ...	do. ...	do. ...	9996	8,248	6·01	495·72	207
Dunalister Mannakins Perees Capture II.	do. ...	do. ...	10392	5,652	6·05	342·20	207
May of Blackheath	Sanatorium, Wooroloo	M.S.	N.Y.A.	12,156	3·99	485·14	207
Mokine Empire Lily V. ...	T. H. Wilding	Jersey	11794	5,197	6·99	363·41	207
Mokine Fancy	do. ...	do. ...	8484	8,641	5·83	504·47	249
Mokine Woodbine	do. ...	do. ...	8487	6,901	5·63	388·84	249
Daisy II. of Garden Hill ...	Walker & Co.	do. ...	10629	6,759	5·20	352·06	207
Creamy of Calcamine	G. C. Spencer	do. ...	10631	5,113	6·03	308·33	249
Primrose of Calcamine	do. ...	do. ...	10062	4,117	5·83	240·18	207

TRIALS WITH IMPORTED VARIETIES OF LUPINS.

I. THOMAS, Superintendent, Wheat Farms, and F. L. SHIER, Agric. Cadet.

In the December number of this Journal for 1924 a preliminary report was made of the results of some 49 varieties of Lupins imported from Germany. Since that date further notes on the growth of these lupins as compared with the ordinary blue-flowered local variety have come to hand from the Experiment Farms.

The imported lupins were of three distinct types, and were classed by the donors as:—(a) Field Varieties, (b) Garden, (c) Perennial.

It is reported that the field varieties are the best suited for agricultural purposes in Germany. In that country they do well on sandy soils and ripen early and evenly under favourable conditions. They are grown very

largely for seed, part of which is used for the feeding of livestock after the alkaloids, which are poisonous, have been removed by soaking, and part is used for green manuring either alone or in conjunction with vetches, peas, or horse beans.

They class under garden varieties those considered only suitable for decorative purposes. Some of these varieties have done well here, and compare favourably with our local type, and will undoubtedly be of more use than for garden purposes.

The perennial varieties have been used extensively in Germany for the binding of sand plains and dunes, and for preparing land for re-afforestation.

Unfortunately these seeds did not arrive until the end of June, and consequently planting was rather later than is considered usual for lupins.

Small plots of each of the varieties with the ordinary lupin at regular intervals for control purposes were planted at each of the Experiment Farms. The Merredin planting was on heavy forest land manured with the usual farm dressing of superphosphate, namely, 95lbs. per acre. At Chapman the land used for these experiments was a light sandy loam, which received in addition 90lbs. of superphosphate and 28lbs. of potash.

Below are the compiled results of observations made by Messrs. E. J. Limbourne and D. R. Bateman, seedsmen at Merredin and Chapman Experiment Farms respectively:—

ANNUAL GARDEN VARIETIES.

Registration No.		MERREDIN.	CHAPMAN.
P. 1647	*Lupinus hirsutus albus* ...	All similar in type to the local variety but making about twice the growth, with larger seeds. Germination was poor.	Only differing from the local variety in the colour of the flower, but making larger growth, with larger seed pods and seed about twice the size of those of the latter.
P. 1662	*Lupinus hirsutus carneus* ...		
P. 1659	*Lupinus hirsutus caeruleus*...		
P. 1674	*Lupinus affinis*	Germination in these three varieties was good while growth was somewhat more bushy in the first two. They may prove useful for ploughing in.	Growth, which was tender and somewhat spreading was very fair in these varieties. Germination was good.
P. 1693	*Lupinus nanus caeruleus* ...		
P. 1671	*Lupinus nanus albus* ...		
P. 1666	*Lupinus succulentus* (bicolor)	Germination good. Early growth spreading but later becoming more erect and bushy. Very prolific seeding. P. 1656 (*Lupinus Californicus*) is probably the best, of this type.	Germination was generally good amongst these varieties, but growth was somewhat slow and poor and not comparable to that of the local variety. Perhaps the best of this section are:—P. 1680 (*Lupinus pubescens elegans*), P. 1656 (*Lupinus Californicus.*)
P. 1654	*Lupinus pubescens*		
P. 1650	*Lupinus hibridus atrococcineus*		
P. 1658	*Lupinus Cruikshankii densiflorus*		
P. 1681	*Lupinus hibridus roseus* ...		
P. 1663	*Lupinus pulcherrimus* ...		
P. 1655	*Lupinus venustus*		
P. 1680	*Lupinus pubescens elegans* ...		
P. 1656	*Lupinus Californicus* ...		
P. 1682	*Lupinus linifolius*	On the whole germination was poor, but the later growth was vigorous and erect. P. 1649 very similar to P. 1653 but probably not quite so good. P. 1645, 1665, 1668 all similar in type to P. 1692 but not so good.	Germination was fair to good with later growth strong, resulting in tall tough stems. P. 1649 tall and similar to P. 1653 but not quite so good. P. 1645, 1665, 1668 similar in type to P. 1692 but very much poorer.
P. 1669	*Lupinus Cruikshankii* ...		
P. 1653	*Lupinus mutabilis*		
P. 1672	*Lupinus pantelericus* ...		
P. 1692	*Lupinus albococcineus* ...		
P. 1649	*Lupinus roseus splendeus* ...		
P. 1645	*Lupinus albococcineus roseus*		
P. 1665	*Lupinus alboviolaceus nanus*		
P. 1668	*Lupinus albococcineus nanus*		
P. 1678	*Lupinus Hartwegi*, blue ...	Germination was poor in these varieties while later growth was only fair. Most of these plants are covered with hairs, which become very hard and sharp on maturity, and would, therefore, be troublesome to stock.	Germination and growth were very poor in these varieties.
P. 1660	*Lupinus Hartwegi, albus* ...		
P. 1675	*Lupinus Hartwegi roseus* ...		
P. 1664	*Lupinus hirsutissimus* ...		

The following Garden Varieties were practically failures at both farms :—

Registration No.		MERREDIN.	CHAPMAN.
1646	*Lupinus Dunetti atroviolaceus*	Very slow in growing. No seed obtained.	Very slow growth, does not appear fixed.
1652	*Lupinus Guatemalensis* ...	Poor, no seed harvested ...	Very poor, only one plant secured for seed.
1661	*Lupinus subcarnosus (texanus)*	Failure	Failure.
1667	*Lupinus Moritzianus* ...	Very late, no seed obtained	Very poor.
1670	*Lupinus luteus Romulus* ...	Poor	Very poor.
1673	*Lupinus concinnus* ...	Failure	Poor.
1677	*Lupinus sulphureus Menziesii*	Failure	Failure.
1679	*Lupinus hibridus fl. pl. President Cleveland*	Failure	Poor.
1683	*Lupinus hibridus inignis* ...	Poor	Only fair.

FIELD VARIETIES.

P. 1686	Merckel's "Liebucher" red	These varieties made better growth and seeded better than the ordinary lupin. They are erect growing, flowering and maturing at the same time as the local variety. The local lupin remained greener longer under the dry conditions than the imported varieties.	All the field varieties made very fair compact growth, and promise to be of value. Germination was good in all these varieties.
P. 1688	Prof. Romer's "Victoria" *Lupinus angustifolius*, blue		
P. 1684	Prof. Romer's *Lupinus angustifolius*, white		
P. 1687	Prof. Romer's *Lupinus angustifolius*, dark blue		
P. 1685	Prof. Romer's *Lupinus luteus*, yellow	These are more spreading types than above. They were badly affected by frosts and growth was poor. They are not at all promsiing.	
P. 1690	v. Calben Vienauer—*Lupinus luteus*, yellow		
P. 1689	Belbe-Hindenburg Templin —*Lupinus luteus*, yellow		

PERENNIAL VARIETIES.

The following is a list of perennial varieties planted, which, under conditions of climate, failed to mature:—

P. 1676—*Lupinus arboreus hybr.* (New.)
P. 1648—*Lupinus nutkaensis.*
P. 1651—*Lupinus polyphyllus Excelsior.*
P. 1657—*Lupinus imperialis roseus.*
P. 1691—*Lupinus polyphyllus.*

BATHURST BURR.

(*Xanthium spinosum*, L.)

W. M. Carne, F.L.S., and C. A. Gardner.

Bathurst Burr is an annual shrubby plant occurring in a few places in Western Australia. It owes its name to the fact that it first received prominent attention at Bathurst, New South Wales, before the year 1850, when it appears to have been introduced in the manes and tails of horses imported from Valparaiso. Originally confined to roadsides it soon spread in all directions, and now it is common in all the States of Australia. Its introduction into Western Australia must have been comparatively recent; we have no record of this, but it does not appear to have existed here until after 1870 and probably much later.

The generic name *Xanthium* is derived from the Greek *Xanthos*: yellow; some of the plants were used in ancient times to obtain a yellow dye. The specific name *spinosum*, which is of Latin derivation, alludes to the strong spines possessed by the plant. The species is now almost cosmopolitan, and it is practically impossible to trace the country of its origin, but it is probably either the Mediterranean region, or South America.

Bathurst Burr is the worst of our noxious weeds. Fortunately it has not obtained the same hold upon this State that it has elsewhere, and therefore it is necessary to take every precaution possible for its extirpation. The plant does not possess a single good quality, being useless as a fodder, a serious trouble in wool, and a nuisance in taking possession of land. It has even been suspected of being poisonous, but this lacks any proof. It may, however, cause mechanical injury to animals should they eat it, which is improbable.

So serious is this weed as a pest that in Eastern Australia it is regarded as being second only to Prickly Pear, and the losses sustained annually amount to some thousands of pounds.

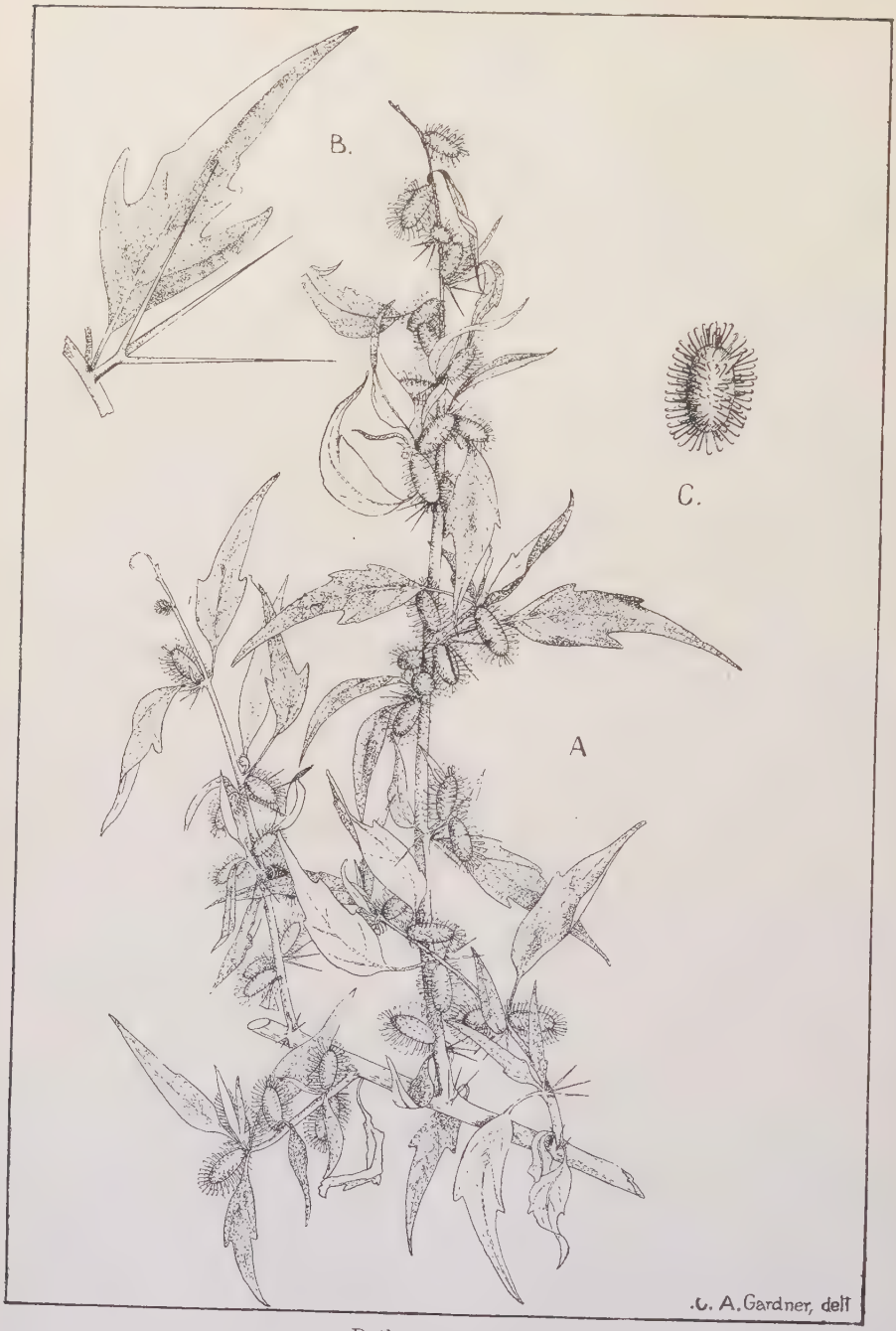
Bathurst Burr has been declared a noxious weed under the Noxious Weeds Act for the whole of Western Australia, and the Road Boards and other local governing bodies are responsible to see that it is eradicated on both private land and in the areas under their control. The Railway authorities are responsible for its destruction on Railway property.

Description of Plant.

A rigid widely-branched shrub of from 1—3 feet high, with narrow, usually three-pointed leaves green above and white underneath, armed with triple spines at the bases of the leaves. Flowers are very small and in clusters at the bases of the leaves, or almost solitary—of two kinds—the upper ones male, and the lower female. The latter are not stalked, and when in fruit form oblong burrs usually half an inch long and densely covered with hooked prickles, which are all curved upwards. These burrs (fruits) are each two-seeded.

The effects of Bathurst Burr and its distribution.

Unlike most members of the Daisy Family (*Compositae*) to which Bathurst Burr belongs, the fruits are not distributed by the wind, but are well adapted to animal distribution. They are covered with small hooked burrs, and readily attach themselves tenaciously to the hair and fleece of animals, or the clothing of man.



Bathurst Burr.
(*Xanthium spinosum*, L.)

A.—Portion of stem with lateral branches.
B.—Young leaf with spines.
C.—Fruiting head or burr.

The fleeces of sheep and the fetlocks, manes and tails of horses, also the tails of cows serve as their principal distributing agents in this country. The presence of the burrs in wool seriously impairs its value as they are extremely difficult to extract.

Bathurst Burr spreads rapidly when once established in a district, especially if assisted by summer rains. The plants tend to form colonies which may extend over quite large areas if allowed to do so, to the exclusion of all other herbaceous growth. They seed freely, and the seeds may lie in the soil in a dormant condition for several years. The burrs are two-seeded. Only one of these may germinate in one year, and the other may remain dormant for some time producing a second plant at a later stage.

Since animals are so largely responsible for the dispersal of seeds, it is only natural that we must look to stock yards and paddocks for its appearance, and principally to the larger saleyards and stock pens for its introduction. We find, therefore, that the plant is established at Kalgoorlie. It has appeared at Robb's Jetty near Fremantle, and around some of the stockyards of the metropolitian area, but these places are under supervision, and in some of them it has been completely eradicated. It has also made an appearance at Pingelly and a few other scattered centres.

Bathurst Burr must, therefore, be looked for in spots where animals stay while in transit, and it should be eradicated upon its first appearance. Where present on railways or roadsides it should be even more closely watched, for these are the arteries along which it is likely to spread by passing people, stock or vehicles.

Control.

It is important to prevent the weed from seeding. This can be done by either grubbing it out or cutting it down before the plant is fully grown or has matured seeds, and it is advisable to burn the plants as soon as they are sufficiently dry, to doubly ensure the destruction of seeds. Cultivation at the proper time, repeated if necessary, should suppress the plant.

THE KITCHEN GARDEN.

G. N. Lowe,

Senior Potato Inspector.

The Carrot.—This vegetable is very easily grown in almost any class of soil, although it thrives best in a deep friable loam. Clay can be made to produce good crops, but, of course, requires even better treatment than is necessary with more easily worked lighter soils. Whatever class of soil is planted to this crop one condition must always be observed: this being that the fertiliser, whether it be farmyard or artificial, should not be applied just prior to planting.

The best results are returned from a plot which has been heavily manured for some previous crop, such as cabbage or cauliflower. It must be remembered that newly manured land causes carrots to become "forky" and misshapen, this being brought about by the insufficient incorporation of the fertiliser with the soils.

Artificial fertilisers will prove beneficial, the weight of the application depending upon the richness or otherwise of the land selected for planting.

A mixture of superphosphate or bonedust and sulphate of potash in the proportion of four parts of the former to one of the latter will be found to give good results if applied at the rate of 3 to 4 cwt. per acre or 2 or 3 lbs. per square rod.

As with all other root crops, potash is required to form in the carrot the maximum amount of starch and sugar, and particularly should this portion of the plant's requirements be furnished adequately in sand, where no natural supply is available.

Artificial manures of correct make up, together with adequate supplies of water, will tend to quick growth, early maturity, and the crispness which is so desirable in every vegetable. Care in this direction will be well repaid.

A most important factor in connection with the preparation of the soil is that it should be well and deeply worked and that the preparation should begin early.

The seed should be planted in rows 9 to 12 inches apart, or, where a large area is planted, up to 15 inches, so that the wheeled hoe of the Planet Junior or Iron Age type may be used and hand hoeing reduced to a minimum.

The seed may be sown either by hand or by means of a hand seed drill. One method employed satisfactorily in this operation is to obtain a wide-mouthed bottle, such as is used for pickles, and a quill or small tube inserted through the centre of the cork, through which the outflow of seed is very easily controlled by the first finger.

Owing to the peculiar hooked formation of the seed, evenness of sowing will be more easily attained if it be mixed with a proportion of clean dry sand, as this will largely prevent the tendency of the seeds to stick together.

Fresh seed should be used always and the depth to plant is about half an inch. After planting the soil should be firmed with the back of the spade and the surface then raked ever so lightly to prevent caking and loss of moisture.

If the germination be good it will be found necessary to thin the plants to three or four inches apart to allow of a proper development. The larger ones may be removed first and so the usefulness of the bed increased.

An early winter sowing, followed at intervals of about three weeks by others—or a succession—as it is termed, will provide a succulent nourishing adjunct to the house-keeping requirements right through to the summer.

In suitable soils and localities sowings can, of course, be made through the summer months and good crops obtained.

For the earliest crop Early Horn or Early Nantes, the "shorthorn" varieties, will be found most suitable and particularly for shallow soils. For main crop and on deep soils the long varieties such as Intermediate, Altringham, Danvers, and Manchester Table should be chosen.

Carrots to be at their best should be pulled a little before reaching full maturity and before the roots get tough and coarse.

Should any difficulty be experienced in heavy soils in the pulling operation, the earth about the roots can be loosened by means of a fork and the roots withdrawn without risk of breaking.

WHEAT YIELDS COMPETITION.

L. Thomas,

Superintendent of Wheat Farms.

In presenting the results for 1925 it is gratifying to observe that there is a marked increase in the number of entrants who filled in their entirety the qualifying conditions attached to the Wheat Yields Competition. It will be remembered that in the preliminary tests conducted last year, and outlined in the March, 1924, issue of the *Journal*, out of 41 original entrants 31 withdrew either voluntarily or by default, leaving only 10 actual participants in No. 1 and No. 2 Zones, whilst No. 3 Zone lacked a single entrant. This year No. 3 Zone had one competitor who fulfilled all the conditions. In both No. 1 and No. 2 Zones there were seventeen competitors respectively. Of these, one in No. 1 Zone and two in No. 2 Zone failed to submit the necessary dockets, and in No. 2 Zone another competitor voluntarily withdrew owing to the large area of sand-plain which he was cropping. There were thus this year 31 farmers who entered this competition and completed the test, and this may be accepted as evidence of awakened interest in the matter. Further evidence of this is shown by the fact that the judges found great interest displayed throughout the wheat belt as a whole in the competition. One feature of the competition which appeals most strongly to farmers is the fact that the whole of the stripped area has to be taken into account, and the actual returns, as disclosed by the sales dockets, and by actual inspection by the judge of seed on hand, are the only accepted evidence of yield.

There is a general belief amongst the competitors in the advantages of fallowing in promoting high and profitable yields, and in consequence a determined effort to plant as much as possible in fallowed land. There is also more similarity in the methods of fallowing than with any other of the operations connected with the production of the crop. The first operation of breaking the land is done during the months of June, July and August, and the general aim is to commence and complete this work as soon as possible. The ploughed land is then invariably cultivated twice in the spring and again before seeding. Some competitors also cultivate during the summer to destroy weeds and mainly after rain.

The implements used vary and are usually such as are adapted to the condition of the soil at the time. The rate of seeding in Zones 1 and 2 ranges from 45 to 70 lbs., 60 lbs. being the more common amongst the competitors who obtained an average yield of over 20 bushels. The application of superphosphate varies from 45 lbs. to 150 lbs., and in No. 1 Zone 90 lbs. is more frequently used than any other; in No. 2 Zone a larger amount, of 100 lbs. and over, is preferred. A general tendency to increase the rate used in former years is noticed despite the increase in the quality now supplied. The month of May may be regarded as the favourite time for planting, and after rain if possible.

The yields which have been obtained in both zones—up to 26½ bushels—show that the competitors have established a very high standard, and a standard which a few years ago would have been regarded as entirely impossible of achievement. What has been done in this respect is having an inspiring influence upon the yield of the general body of farmers throughout the wheat belt, and its effect must increase.

The judging was carried out on similar lines to that adopted in connection with cropping competitions, but, in addition, the actual areas stripped were measured for the purpose of calculating the average yield when the dockets were submitted.

The marks allotted to the competitors in No. 1 Zone are as follow:—

WHEAT YIELD COMPETITION.

No. 1 ZONE.

Competitor.	District.	Acreage.	Average Yield per acre.		Yield.	Freedom from Weeds.	Freedom from Disease.	Freedom from Admixture.	Evenness of Growth.	Grand Total.
			Points		35	25	15	15	10	100
			bus.	lbs.						
Lindsay, J. ...	Wyalkatchem...	390	26	35	27	21	13	13	7	81
Dunkley, G. ...	Yelbeni ...	500	25	55	26	21	13	12	7	79
Hughes Bros. ...	Minnivale ...	347	24	15	24	21	13	13	7	78
Hammond, J. D.	Kellerberrin ...	567	23	9	23	21	13	13	7	77
Lethlean, J. ...	Bruce Rock ...	390	24	3	24	21	12	13	7	77
McCarthy, P., & Son	Eujinyn ...	765	23	49	24	20	12	13	7	76
Dumsday, L. ...	Goomarin ...	335	21	25	21	19	12	12	6	70
Ball, H.	Yelbeni ...	600	19	11	19	18	12	11	6	66
Spillman, J. W. ...	Nth. Baandee	510	18	13	18	18	12	11	6	65
Spillman, D. J. ...	do. ...	410	17	24	17	18	12	11	6	64
McManus Bros. ...	Nth. Bencubbin	385	11	38	12	21	13	12	6	64
Pollock, R. ...	Belka	541	14	54	15	18	11	12	6	62
McLellan, J. ...	Mt. Stirling ...	360	14	47	15	18	12	11	6	62
Lehmann, C. E. ...	Dukin	600	13	2	13	18	12	12	6	61
Bradford, R. and L.	Ballidu ...	395	10	25	10	18	12	12	6	58
Bell Bros. ...	Dalwallinu ...	1,410	14	56	15	15	12	8	5	55

The following details regarding the two prize-winners for No. 1 Zone, as supplied by the judge—Mr. H. Rudall—are given:—

"Mr. Lindsay's farm is situated six miles from Wyalkatchem. The holding comprises 1,320 acres, of which 1,250 are cleared. Of this area there were 420 acres under wheat, 290 under oats, and 480 acres of fallow. Of the area under wheat 30 acres were cut for hay, leaving 390 acres to be stripped for grain, which yielded an average of 26 bushels 35 lbs. The land under wheat was ploughed 4in. deep in the previous June and July with a mouldboard plough. In August it was then cultivated with a Spring Tyne cultivator. With the exception of a small homestead paddock, the whole was double-disced in September, and then again cultivated with a Spring Tyne in October. It was harrowed after rain in January, and cultivated with a Spring Tyne in March and April, just before sowing. The seed used was graded, and treated with bluestone to prevent smut, and was second-year removed from the pedigreed seed obtained from the Experiment Farm. The whole area, with the exception of 50 acres in the homestead paddock, was not sown until after rain in May. The two principal varieties used were 'Nabawa' and 'Gluyas Early.' The 'Nabawa' was sown at the rate of 50 lbs. of seed, and 'Gluyas Early' at the rate of 60 lbs. The rain which fell from the 1st May to the 31st October, as recorded by the gauge on the farm, was 995 points. It is interesting to note that the average from 1915-1923, not including the competition crop, has been 19 bushels per acre from this farm. The holding is surrounded by a rabbit and dog-proof netting fence, and worked on the three years' system. Of the 290 acres of oats 100 acres were used for grazing

only. This 100 acres, together with the grazing on the fallow to keep down the weeds, carried 400 ewes and 300 lambs from May until October; of these 253 were sold as fats in October, leaving 436 to be carried over until the wheat and oat crop stubble was ready for grazing throughout the summer. The work on the farm is carried out by means of a 'Case' tractor and two 6-horse teams."

"Mr. G. Dunkley, who was awarded second place, has a holding of about 3,000 acres, eight miles from Yelbeni, of which approximately 2,200 have been under cultivation. This holding is enclosed with a rabbit and dog-proof netting fence, and subdivided into paddocks fenced with rabbit netting. This season there were 610 acres under crop, 500 being wheat and 110 oats; 410 acres of the wheat were fallowed, and 80 acres were stubble ploughed. The varieties used were 'Nabawa,' 'Federation,' 'Merredin,' 'Gluyas Early,' 'Gluyas Late,' 'Canberra,' and 'Onas.' The 410 acres of fallow were ploughed 4 inches deep during the period June to August, both mouldboard and disc types of plough being used. The ploughed land was cultivated three times before harvesting time, and twice between harvest and planting period. The crop was sown after rain, commencing on 20th May and ending on the 17th June. The rate of seeding was 60 lbs. of seed, and superphosphate was applied at the rate of 130 lbs. After drilling the ground was harrowed. Since the holding has been secured from dogs sheep have been carried, the number pastured throughout the year ranging from 500 to 1,000. This farm is worked by three 7-horse teams and tractor."

In No. 2 Zone the points allotted to the various competitors are as under:—

WHEAT YIELD COMPETITION.

No. 2 ZONE.

Competitor.	District.	Acreage.	Average Yield per acre.		Yield.	Freedom from Weeds.	Freedom from Disease.	Freedom from Admixture.	Evenness of Growth.	Grand Total.
			Points		35	25	15	15	10	100
			bus.	lbs.						
Keays, P. ...	Corrigin ...	495	25	29	25	23	12	12	8	80
Bowen, T. ...	Wongan Hills...	544	26	31	27	20	11	12	7	77
Dall, S. C. ...	Quairading ...	286	21	6	21	21	13	13	8	76
Morrell Bros. ...	Greenough ...	215	23	7	23	19	13	13	8	76
Ackland, R. B. ...	Wongan Hills	352	20	41	21	21	13	12	8	75
Carter & Son ...	Three Springs...	241	25	35	26	18	12	12	7	75
Richards, T. ...	Dangin ...	195	22	...	22	20	12	12	8	74
Hayward, A. L.	Dindiloa ...	230	15	7	15	22	14	14	8	73
Elder, A. ...	Moulyinning ...	361	21	16	21	19	13	12	7	72
Spencer & Son ...	Wongan Hills...	264	22	53	23	19	11	12	7	72
Mott, C. ...	Moulyinning ...	178	20	37	21	19	13	12	7	72
Gottsch Bros. ...	Dudinin ...	617	15	53	16	20	13	13	7	69
Nicholls, Robt. ...	Kondinin ...	426	14	8	14	19	12	12	7	64
Hebiton & Sons...	Three Springs...	*218	*	*	*	19	13	12	8	52

* Half of this Competitor's acreage was destroyed by hail.

The total area of the holding of the winner in this zone, Mr. P. Keays, is 2,500 acres, of which 1,500 acres are cleared, consisting mainly of salmon gum and gimlet, with a little morrell, jam and York gum country. The area stripped for wheat for the competition was 495 acres, 100 of which was ploughed prior to planting, the balance being fallowed during the winter months. The fallowed land was ploughed 4 inches deep between the months of June, July, and August. On the heavier land a mouldboard plough was

used, and a disc on the lighter soil. The subsequent cultivation was commenced when the ploughing was completed, and was carried out largely by means of the Spring Tyne cultivator, but, if found necessary, a disc cultivator was used to deal with the earlier ploughed land, which had been "set" by the rains and was too hard for the Spring Tyne cultivator. The general system adopted was to cultivate about twice during the spring, and again just prior to seeding, but this was not rigidly adhered to, the cultivation given to the fallow being governed by its condition, the object aimed at being to obtain a seed bed free from weeds and with a uniform loose mulch. The condition of the ground determined what type of implement was necessary to achieve the desired result. The varieties used were "Belka," "Nabawa," "Merredin," and "Gluyas Early." The seed was treated with bluestone to prevent smut, and was sown at the rate of 60 lbs. per acre for "Gluyas Early" and 45 lbs. for the other varieties. Superphosphate was applied at the rate of 60 lbs. No sheep are kept, as facilities for this purpose are not yet provided. This competitor realises the necessity for fallow and is aiming to reach the stage when he will plant entirely upon fallowed land, and this year the area fallowed for next year's crop is 450 acres. One 6-horse team and a tractor are used. The earlier sown crops were harrowed during June and July on account of the dry spell. A similar dry spell was experienced in September, but fortunately this was followed by good rains in October. Planting commenced the second week in April and finished the last week in May.

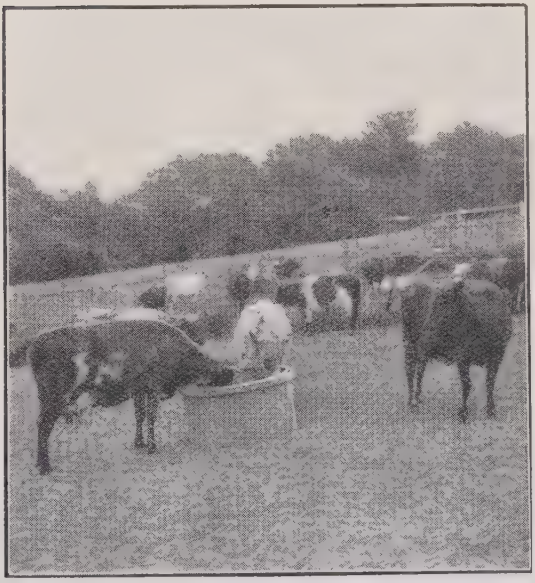
The second prize winner, Mr. T. Bowen, had two farms competing in the Wongan Hills district, and, under the conditions of the competition these farms had to be treated as one entry, even though they were 21 miles apart. The total area of both farms is 2,300 acres. The area stripped was 544 acres, and consisted mainly of salmon gum, morrell, and York gum, with a little ti-tree country. The land had been ploughed four to five inches deep during June and July with a mouldboard plough, and cultivated with a Spring Tyne implement immediately after ploughing. It was also cultivated after rain during the summer with the same implement except where the rain had set the soil, and then with a disc cultivator. The varieties used were "Nabawa," "Federation," "Gluyas Early," and "Gresley," the seed of which had been graded and portion pickled. Seed was sown at the rate of 60 lbs. per acre, with an application of superphosphate at the rate of from 100 to 110 lbs. The general system of working the farm was fallow and crop, but it is now intended to work it on the three-course system of fallow, crop and pasture.

Credit must be given to Messrs. Hebiton & Sons, Three Springs, for the very good crop which they had, but who were extremely unfortunate in suffering heavy losses by hailstones, estimated by them to be approximately one-half their yield, for they were well to the fore in regard to points awarded for sound methods of cultivation.

In No. 3 Zone Mr. W. Sewell was the only competitor to compete with a stripped area of 295 acres, from which an average was obtained of 14 bushels to the acre. The points awarded to this competitor were:—Yield, 15 points: freedom from weeds, 22 points; freedom from disease, 12 points; freedom from admixture, 13 points; evenness of growth, 7 points; making a grand total of 69 points out of a possible 100.

Mr. Sewell has been public spirited enough to offer to withdraw from this competition in order that a new one may be commenced, thus affording others in his zone an opportunity of competing and also representing the zone.

Mr. Sewell is to be commended for his sportsmanship in voluntarily relinquishing any advantage he has in connection with this Championship Competition, and which he might have secured by being the only competitor in Zone 3. His offer has been accepted, and the competition will now be thrown open to others eligible for entry in that zone. Those entering this year will have equal opportunity with Mr. Sewell, for it has been decided that the competition in Zone No. 3 shall run for two years only so that it will end simultaneously with the competitions in Zones Nos. 1 and 2. It is to be hoped that Mr. Sewell's generous offer will meet with a deserved response from the farmers concerned, and that the friendly rivalry which will result from this competition will stimulate competitors in that zone to secure increased yields. Entries for the 2-years' competition in this zone will, therefore, close on September 1st, 1925, with the Secretary, Royal Agricultural Society, Perth.



WHEAT YIELDS COMPETITION.

Entries Invited for Zone No. 3.

Owing to the action of Mr. W. O. Sewell, of Pingelly, the only competitor in Zone 2, who generously withdrew and forfeited the advantage he had of a "walk-over," a new Wheat Yields Competition extending over two years in Zone 3 has become possible.

In this zone, which comprises the districts having an annual rainfall of 20 inches or over, a Champion Cup, valued at £20, will be awarded to the competitor who, during the next two consecutive seasons, obtains the highest aggregate number of points for the whole of the wheat crops which he harvests for grain.

In addition to this Champion Cup there will be awarded each year two prizes, valued respectively at £5 and £3, to the competitors who are judged to obtain first and second places in the competition in each of these years.

The minimum area to be stripped for competition purposes is 150 acres, this small area having been chosen so as not to exclude settlers who follow sound farming work by devoting a portion of their crop to oats and fodder crops. Any portion of the crops which are cut for hay must be taken in distinct blocks so as to satisfy the judge that such portions have not been removed with the object of trimming the grain crops, and thus probably enhancing their yield. The area of any farm in which a competitor is financially interested must be included in this competition.

The awards will be made in accordance with the following scale of points:—Yield, 35 points; freedom from weeds, 25 points; freedom from disease, 15 points; freedom from admixture, 15 points; evenness of growth, 10 points; making a grand total of 100 points.

The prize winners each year, and the winner of the Championship, must exhibit one bag of wheat at the Royal Agricultural Show held subsequently to the award. The points allotted for yield will be determined by the actual quantity of wheat sold, or remaining on the farm for farm use. A competitor must supply to the judge docket notes of the wheat sent from the farm, and furnish such other information as may be required in connection with the grain harvested from his crop. He must arrange for the judge to be met on arrival of the train at the nearest siding, and convey him to the train on return. The time of judging will be arranged, and the judge will be appointed by the Director of Agriculture. The judge's decision in all matters will be final.

Entries for this competition in this zone will close on 1st September, 1925, with the Secretary, Royal Agricultural Society, Perth.

VITICULTURAL NOTES FOR JULY, AUGUST, AND SEPTEMBER.

H. K. Johns,

Viticulturist.

JULY.

During this month work in the vineyard is confined mainly to pushing ahead with pruning, burning-off, ploughing, etc., as the days are short and there is a percentage of wet ones as well: consequently vineyard work, except in a few dry and hilly localities, is hindered. Land should be marked out for new plantations, and the planting of young rooted vines proceeded with. Land where clay subsoils and hard pan occur should be well trenched, and a thorough method of drainage on all low-lying country should be brought into operation. All young vines planted last season should be permanently staked or trellised.

Cellar.—The first racking of young wines should have been completed, and all dry wines filled up regularly.

AUGUST.

The pruning of all vines should be completed before the end of this month, as well as the tying down of rods of long-pruned vines; also removal of all prunings, completion of first ploughing and hoeing, so that the land is in good tilth before the buds burst.

Swabbing and Spraying—Black Spot (*Anthracnose*).—Whenever this disease has become established or where any signs of it were noticed last spring or summer, swabbing will be essential, and commercial growers who desire clean crops of fruit fully realise the grave danger of neglecting swabbing or spraying. The sultana is most susceptible to this disease, while several varieties of table grapes are often very severely attacked. A two-fold treatment is generally adopted, consisting, firstly, of the winter swab or spraying, to be completed before the buds begin to swell, which is designed to destroy the wintering forms of the fungus, and secondly, spring and summer spraying with copper mixture to prevent the spread of any fungus resulting from the development of any wintering form which may have escaped destruction by swabbing.

The following is a formula which has proved satisfactory as a winter swab or spray to be applied just before bursting of the buds:—Iron sulphate, 35lbs.; sulphuric acid, 8lbs.; water, 10 gallons; or a very strong Bordeaux mixture, as follows:—Bluestone, 20lbs.; lime, 20lbs.; water, 40 gallons. Success has been met with this mixture in the Swan vineyards, and growers there favour this mixture in preference to the iron sulphate spray.

Given suitable weather conditions fresh infection will, no doubt, occur, and this must be combated with a spring treatment of copper mixture, made up as follows:—Copper sulphate, 6 lbs.; fresh quicklime, 4lbs.; water, 40 gallons.

The planting of young vines should be completed this month.

Cellar.—All young wines should have their second racking completed. Keep all dry wines regularly filled up.

SEPTEMBER.

Cultivation should receive every attention this month, ploughing to be completed, and cultivators kept briskly going where soil conditions are suitable.

Black Spot (*Anthracnose*).—Spring spraying with copper mixture, as follows, to be applied:—Copper sulphate, 6lbs.; freshly burned lime, 4lbs.; water, 40 gallons.

Oidium.—Owing to the abnormal rains and humidity during the ripening stage of the grape this season, Oidium was prevalent in most vine-growing districts, and given suitable weather conditions it will no doubt make its appearance this coming season; therefore a spraying of lime sulphur solution before flowering time will be very advantageous in checking an outbreak. This solution has certain advantages over the dry dusting of sulphur, as it vaporises at a lower temperature, and is not so easily washed off by the rain. As the season goes on dustings of sulphur should be applied on moist muggy days in the early mornings as far as practicable, at intervals of ten days, during the later growing periods of the vine.

Cellar.—Closely examine all young wines. Any doubtful wines should receive immediate attention. Rack older wines. Dry wines to be regularly filled up.

LOCUSTS.

Warning.

L. J. Newman, F.E.S.,
Entomologist.

During July or August the young locusts will be issuing from the egg tubes in the ground. Farmers and those concerned must be on the alert and take immediate action to poison off these hoppers.

1. The following formula has been found to be most effective:—

Bran	30lbs.
Molasses	5lbs.
Arsenite of Soda	1lb.

Method of Making.—Dissolve the arsenite of soda in ½ gallon of water (hot for preference). Likewise dissolve the molasses in 1 gallon of hot water. Allow both to cool before mixing the soda and molasses together. Stir this mixture into the bran until it is of such consistency that, when distributed, it will break into fine particles. *Avoid lumps.*

If not using arsenite of soda an equal amount of Paris green may be substituted. The Paris green is used and mixed with the bran in a dry form, the molasses and water being added after the bran and Paris green have been thoroughly mixed.

2. *Spray.*—The hoppers and surrounding grass and vegetation may be sprayed with the following poison:—

Arsenite of Soda	1lb.
Molasses	4lbs.
Water	16gal.

Method of Making.—Disolve the arsenite of soda in ½ gallon of hot water, likewise dissolve the molasses. When cooled add the two together, bringing it up to 16 gallons, mixing thoroughly. Keep agitated when using.

Note.—Being a poison, handle carefully, and keep all animals off foliage so treated for at least three weeks after the last application. Baits or sprays must be applied in the early morning before 10 a.m., or late in the evening, so that the bait will be fresh and tempting to the massed locusts, which have fasted all night. Locusts will not partake of a dry bait. Repeat treatment once a week until the pest is destroyed.

For fuller information apply to Department of Agriculture for Bulletin No. 142.

THE FARM WATER SUPPLY.

GEO. L. SUTTON,
Director of Agriculture.

Farm operations cannot be conducted without a water supply, and a plentiful supply is essential for comfort. Despite these indisputable facts, it is surprising how many farmers are enduring the privations and loss consequent upon having an inadequate supply, and how few, even amongst the more advanced, have provided themselves with the means of enjoying the benefits and comforts of the liberal supply which they have within their power to secure.

In many instances expense and hardships, due to a scarcity of water, are unavoidable during the pioneering stages, and especially during the early stages of development. A striking instance of the expense involved is furnished by the experience of Mr. Greenham, "Oakbank," Badgerin, who, when he commenced his farming operations, was compelled to cart water from the nearest well for a period of about six months. During this time he travelled twenty-seven miles each day for water, his return load was 230 gallons, just over a ton, and the aggregate distance travelled was nearly 5,000 miles. During his first harvest he was compelled to cart water for three days in order that he might use the harvester for two days.

Water Condenser at "Thirty-mile."

Even more costly and troublesome than carting water a reasonable distance is the method of providing a water supply for farm requirements by means of a "condenser," which was used when the well water available for domestic or stock purposes was too salt for consumption. In the early days water was obtained in the outback areas by the use of condensers, but now,

large agricultural areas North and South of the Eastern Railway are supplied with water from the Goldfields Water Scheme by branch pipe lines, which are laid from the main pipe lines where required.

The illustration shows one of the last of the condensers to be superseded. It was situated on the Esperance-Norseman road, and was known as the "Thirty-mile" condenser, so called because it was thirty miles from the last camping place at which there was a well. With the two boilers continually going it had a production of 2,500 gallons per week. At one time it was generally believed that, as most of the wells in that district were salt, it would be dependent upon condensers for its water supply, but fortunately since then it has been found that water can be stored in excavated earthen tanks, and the stored water supply is probably equal to that of any agricultural district in the wheat area. This experience should convey a message of hope to those whose water supply is inadequate for their requirements at present, and believed to be so for the future.

Tanks of water left for settlers at Railway Siding. This should be the last line of reserve, not the first.

In very many cases the period of a scanty water supply is unnecessarily and unduly prolonged. The causes of this are many and various, and it is believed that one of the most common in this State is the regularity of our winter rainfall, which tends to lessen the sense of responsibility regarding the necessity for water conservation, which is, however, just as essential under our favourable conditions as in other States. This avoidance of responsibility results not only in the unsatisfactory and unprofitable work of carting water often for domestic as well as stock use, but entails that great discomfort to all which is unavoidable when the farm is compelled to exist upon a famine allowance of water. In addition to being expensive it hinders, if it does not entirely prevent, the profitable performance of the cultural operations incidental to the season of the year.

Settlers who fail to realise their responsibilities in connection with water conservation rely upon public wells and tanks, and water which the State carries over the railways at less than cost. They are, indeed, fortunate in having these supplies to fall back upon, but they should, however, not be looked upon as the first line of reserve, as many now regard them, but rather as the final line to be called upon only when the fullest possible conservation has been made on the farm and become exhausted. This transported water is very costly. How much more costly it is than farm conserved water the farmers who still continue to depend upon it evidently fail to realise, or they would take steps to provide more adequate storage on the farm.

In many instances the cost to the settler at the railway is 2s. 6d. per 100 gallons; to this must be added the cost of loss (leakage) and carting to the farm, so that the cost landed at the farm is probably 4s. or 5s. per 100 gallons. One cubic yard of earth with a storage capacity of over 160 gallons can be excavated for about 1s. 6d.; allowing 10 per cent. interest on 1s. 6d., the interest charge would be less than 1¾d. for each 100 gallons storage capacity per annum. Assuming that losses by evaporation and seepage* were such that 10 times as much water had to be stored as was available for use, the cost with farmers' own storage in an earthen excavated tank would be, say, 18d. per 100 gallons instead of 48d., which is now the cost of the same quantity carted by road and rail.

Further information on this point is afforded by the following table:—

TABLE SHOWING PRICE OF WATER AT PER 100 GALLONS, AND THE CAPITAL EXPENDITURE WHICH THIS REPRESENTS.

Price per 100 gallons per annum.	Capital sum represented in shillings with interest at:		
	6%	8%	10%
3d.	4·16	3·12	2·6
6d.	8·33	6·25	5·0
1s.	16·66	12·5	10·0
2s.	33·33	25·0	20·0
3s.	50·0	37·5	30·0
4s.	66·66	50·0	40·0
5s.	83·33	62·5	50·0
6s.	100·0	75·0	60·0

From an examination of this table it will be seen that it is equally as profitable for a farmer to provide his own water supply at a capital cost of 40s. per 100 gallons storage capacity, and pay 10 per cent. on the money invested as to purchase it at 4s. per 100 gallons. Almost every farmer will readily realise that he can do better than this, even if the supply required is stored in galvanised or concrete tanks. Iron tanks provide very effective water storage and cost in agricultural districts from £5 to £8 per 1,000 gallons storage capacity, according to size; this is equivalent to from 10s. to 16s. per 100 gallons. From the table above it will be seen that even if 10 per cent. interest on the money invested is required, the cost per 100 gallons at the lower price for tanks would be 1s., or one-quarter that of the transported water even if the tank were only filled once, and it is more than likely that it would be filled at least twice.

* It is believed that tanks constructed as described herein will be free from this source of loss.

Assuming that of the 168 gallons of water capable of being stored in one cubic yard of excavation, 100 are effectively conserved and available for consumption, this table further shows that 4s. per cubic yard of excavation could be spent to provide the farm water supply if the money were obtainable at six per cent., or 3s. if the interest is eight per cent., or 2s. 6d. if 10 per cent.

Only in rare instances have wheat farms a good natural permanent water supply. In many instances good water is obtained by sinking shallow wells, but in the majority of cases the necessary provision for domestic requirements can be made only by conserving the rain water as it runs off the roofs of houses and outbuildings; and for stock by excavating earthen tanks or dams in suitable sites, where the water from the catchment area can be led into them by means of drains or gutters.

A cement storage tank, "Tillellan, Wagin. Specially suitable for waters which corrode iron tanks.

For storing rain water for domestic purposes nothing better is known than either the galvanised iron or cement tank. The former has the advantage that it is lighter and can be moved from place to place, and in the small sizes is cheaper than the latter. Owing to the large amount of evaporation which takes place during the summer in hot climates, all the tanks should be covered. The "cone" top is to be preferred as it tends to throw off dust and other impurities rather than to accumulate them, and the cover will also prevent the formation of a green scum on the water.

There are quite a number who fail to realise the quantity of water available to them from roofs for storage in a district of scanty rainfall. The roofs of the homestead and outbuildings, particularly if constructed of galvanised iron, form excellent catchment areas, which should be used to the fullest possible extent for domestic use, unless as good supplies are available in a cheaper way. Because of its great usefulness in this connection a ton,

or even half a ton, of galvanised iron is a very useful and economical investment on a farm in any stage of its development in order to provide a water supply, whilst at the same time protecting the settler and his chattels from the weather. For the same reason the galvanised iron verandah surrounding the settler's bungalow homestead serves a double purpose: in addition to protecting his residence from the glare and heat of the noonday sun, it increases the quantity of water available for storage. Practically the whole of the rain falling on a galvanised roof can be conserved, so that if it be remembered that there are about six and a-quarter gallons in a cubic foot, the number of gallons available for storage can be ascertained by a simple calculation. A rough method is to estimate half a gallon per inch of rainfall for every surface foot covered by the building.

In column two of the following table will be found the number of gallons of water falling on the roof of a house covering a surface area of 30 feet by 40 feet, when the rainfall is as shown in column one. Similarly in columns three and four will be found the number of gallons falling upon outbuildings capable of being covered by one ton of iron, in column three when the roofs are gabled, and in column four when they are of the skillion type:—

GALLONS OF WATER AVAILABLE FOR STORAGE.

Rainfall in inches.	House 30 x 40	Outbuildings with gabled roofs covered by 1 ton of galvanised iron.	Outbuildings with Skillion roofs covered by 1 ton of galvanised iron.
1	625	962	1,100
2	1,250	1,925	2,200
3	1,875	2,887	3,300
4	2,500	3,850	4,400
5	3,125	4,812	5,500
6	3,750	5,775	6,600
7	4,375	6,737	7,700
8	5,000	7,700	8,800
9	5,625	8,662	9,900
10	6,250	9,625	11,000
11	6,875	10,587	12,100
12	7,500	11,550	13,200
13	8,125	12,512	14,300
14	8,750	13,475	15,400
15	9,375	14,437	16,500

Whilst the excellence of the roof supply of rain water is recognised for domestic purposes, it is doubtful whether many farmers take full advantage of it, and few indeed ever consider its possibilities as a source of supply for any of their stock. In this connection Mr. Hancock, of Belka, provided the six horses comprising his team with water from this source stored in galvanised tanks. He found that 10,000 gallons stored in this way was quite sufficient for his team throughout the season, for, in addition to starting with the tanks full at the end of the rainy season, further supplies would be obtained from showers. Incidentally it may be stated that each of the tanks used had a capacity of about 3,300 gallons, with a circumference made with 10 feet sheets of curved iron, and were eight feet high. The tanks were covered to strengthen them and to minimise evaporation. This size, and type, was adopted as the one which proved to be the largest which could be moved about with convenience.

The earthen tanks, which are the recognised economic method of conserving water for stock when a good supply from wells cannot be obtained, and which are so largely used in agricultural areas, are rectangular or square excavations with gradually sloping sides. The size ranges from a few hundred to a few thousand yards capacity, and the cost by contract ranges from 1s. 3d. per cubic yard upwards. Such excavations provide storage capacity at a fairly cheap rate, as may be seen from the following table:—

TABLE SHOWING THE ANNUAL COST OF STORING 1,000 GALLONS OF WATER IN EXCAVATED TANKS, WITH DIFFERENT RATES FOR EXCAVATION AND WITH INTEREST AT 6 PER CENT.

Rate per Cubic Yard.	Annual Cost per 1,000 Gallons Capacity.
s. d.	d.
1 3	5·4
1 6	6·48
1 9	7·56
2 0	8·64
2 3	9·72
2 6	10·80
2 9	11·88
3 0	12·96

It is somewhat difficult to decide what provision in the form of excavated tanks should be considered an adequate water conservation for the needs of our stock. This depends upon the character and regularity of the rainfall, and consequently the periods of scarcity for which from time to time provision may be required. During winter, and especially when there is plenty of succulent feed available, stock drink very little water, and sheep have been known to thrive for months without any at all. In dry times, however, and during hot weather, when feed is dry, the stock require a great deal; sheep will then drink about a gallon a day and horses eight to 10 gallons.

In our wheat belt there is invariably each year a period of six months during which the weather is warm and feed dry, so that it is essential to make provision for this period. Then it must be remembered that though our winter rains are very regular, many of the falls are not such as will cause water to flow into a tank from an ordinary soil catchment, and because of this it cannot be assured that the tanks supplied by such catchments will be full at the beginning of the dry period. It is therefore necessary to make provision for at least 12 months' supply of water for every head of stock it is intended to carry. For sheep, this means a provision of say, 365 gallons, or, as one cubic yard has a capacity of 168¾ gallons, of 2¼ yards effective storage. To this must be added an amount of, say, ¾ yard to cover loss by evaporation, seepage, etc., thus a minimum provision of three cubic yards for each sheep and 24 to 30 cubic yards for each head of large stock should be made. This estimation should be regarded as the margin of safety, and much greater conservation effected as opportunity occurs. In this connection it is understood that the Victorian Water Commission considers that an open storage tank of 2,500 yards capacity provides the minimum supply necessary for a farm of 700 acres, and which will carry 200 sheep, 6 cattle, and 12 horses.

A very serious feature in connection with open earthen tanks is the enormous amount of water lost from them by evaporation during our warm summer months. At the Merredin Experiment Farm the mean annual evap-

oration for the past ten years from a water surface, kept at about ground level, has been 84·778 inches. The evaporation from the usual earthen tank would not be quite as great, for the water surface would be protected to some extent by the embankments. Experience indicates, however, that it is very great, and is probably not less than six feet. With small or shallow tanks the toll is too great to be permitted. How great is the toll may be better

Framework of bush timber erected to support scrub-covered roof of excavated tank.

realised from figures relating to the calculated loss in connection with a tank 9 feet wide and 30 feet long at the bottom and 9 feet deep, with 2½ to 1 batters all round:—

	Yards.	Gallons.	%
Total capacity	607	102,431	100
Loss by evaporation	536	90,450	88
Available for consumption	71	11,981	12

In this case only 12 per cent. of the stored water is available for consumption. With a deeper tank the percentage available is greater, but the loss is still tremendous, as may be seen from the following figures relating to a similar tank with the same dimensions at the bottom, but 16 feet deep:—

	Yards.	Gallons.	%
Total capacity	2,348	396,225	100
Loss by evaporation	1,580	266,625	67
Available for consumption	768	129,600	33

In this case the percentage available for consumption has increased from 12 to 33 per cent., due to the increase in depth. It is, therefore, obvious

that the most economical open tanks are deep ones. With very large and very deep tanks it may be cheaper to put up with this loss than to endeavour to prevent it. With small or shallow tanks this is, however, not the case, and because of this, the old shallow pothole should no longer be tolerated by any up-to-date farmer. The quantity of water which can and is evaporated by sun and wind, and which is measured by feet, not inches, soon empties a shallow tank, and makes it a mere expanse of drying mud. Water in the wheat area is too precious to be wasted by evaporation, and some effort should be made to avoid it.

Experiments in the laboratory suggested that a very thin film of oil spread over the surface would have the desired effect, but this has not proved to be the case. In the open it has been found that dust settles on the oil and causes it to sink to the bottom, or else the wind drives it to the sides where it is absorbed by the soil, and its usefulness is ended. Other methods, including the growth of aquatic plants, have been tried without success. The only satisfactory method is to roof the tank with iron, poles, brush, or straw. The settlers' usual plan is to use a cover of poles or brush supported on a framework of bush timber, as shown in the illustration. This has proved to be very effective. To facilitate the roofing of tanks they should be as narrow as it is convenient to make them. Though some evaporation is due

Roof of poles to reduce evaporation.

directly to the action of the rays of the sun, by far the greatest amount is caused by the wind. It is advisable, therefore, to protect the water in the tank from its effect by means of shelter belts of trees left or planted a short distance away from it.

The first essential operation in connection with the construction of these earthen reservoirs is to secure a site to which the "run off" from higher land can be conducted to them by means of drains or gutters. In undulating

country such a site can be located without difficulty, but in flat country the finding of a suitable site is much more difficult, in fact, such country often appears to the unaided eye so level that water will not run. Rarely indeed, is this the case, but it is often advisable to have some levels taken for guidance before fixing the site, for experienced men have been known to mistake the direction of the fall on such land. Very often shallow water courses exist, and these will assist in the selection of the site. If the soil holds water well, the tank should be located at or near one of these water courses. Good clay is the best material for these excavations, and on some holdings a tank will hold almost anywhere, but on others some difficulty will be experienced in securing a suitable place in which to sink the tank. It is always a good plan, before the tank is commenced, to sink several bores or trial holes to the depth it is proposed to excavate the tank, so as to determine the nature of the ground. An experienced man can tell by the nature of the subsoil whether the tank will hold. If there is any doubt on this point, the trial holes should be filled with water so that the ability of the ground to hold water can be definitely determined. A good holding clay may carry a fair percentage of grit, and each is especially good for building embankments.

Rock catchment, Koolberin, with low gutters leading water to storage to be conserved.

A good catchment area is quite as important as the site for the tank. A tank with a capacity of 1,000 yards requires rather more than seven acre inches to fill it. The actual extent of the catchment area required will depend upon what precentage of the actual rainfall will run off to be collected. This varies according to the nature of the ground, and with the character of the rainfall. Hard compact soil is infinitely better than sand or soil which cracks when dry, and absorbs a large quantity of water before any reaches the tank. Roads make good catchments, and the water can be diverted from these towards the tank by means of shallow spoon drains which, however, when they

cross the road should extend in each direction at least one foot for every inch in depth. The natural run off of the usual soil catchment can be very much improved by any means which compacts the surface. Sheep are excellent for this purpose, and the tracks they make tend to direct the water to the drains; but cultivated lands are unsuitable catchment areas.

The best natural catchments are rock ones, and where these exist, as they do in many holdings, even light showers can be utilised to supplement the conserved supply. By building shallow gutters with rough stones along suitable contour lines the usefulness of many rock catchments can be immensely increased. This has been very successfully carried out on the rock catchments attached to the Government tanks on the Eastern Goldfields railway line, and at other places. The illustration shows work of this kind successfully carried out by Mr. W. N. Hedges, at "Koolberrin," where practically the whole of the water falling on this rock is turned to useful account, whereas without these artificial gutters quite half the water would flow in directions where it could not be stored. The low walls forming the gutters are built with irregular-shaped spawls, broken out of the scaly portion of the rock and having a rough flat base. They are placed on their base in position on the contour line marked out for them and with a slight lean outwards, and if necessary are held in position temporarily by means of a light backing of earth; they are finally pointed up on the back with cement mortar and grouted in with cement on the front.

Large "gnamma" hole, Koolberin, covered with poles to reduce loss due to evaporation.

It is as necessary to trap the water from soil catchments as on the rock ones, in the former case by means of drains dug out of the solid soil. These drains or gutters are given no more fall than is necessary for the water to run freely. The effect of this is to make the most of the catchment area available, and in the case of the drains, prevents scouring. Two inches fall to

the chain is quite sufficient, as the depth of water also gives a fall. A drain 6in. deep with a fall of 2in. to the chain would, when full, give an 8in. fall to the chain, *i.e.*, from the top of the water to the bottom of the drain.

It is not difficult to locate the position of the drains or gutters on the catchment area, it can be done readily with the aid of a straight edge and a spirit level. For this purpose the spirit level is attached to the top side of the straight edge, and at one end on the under side a piece of wood in thickness to correspond to the amount of fall desired in a distance equal to the length of the straight edge. Thus, if the fall desired is two inches to the chain, which is ample for a rock surface, and the length of the straight edge is 16 feet 6 inches, the thickness of the wood will be ½-inch, or ¼-inch if the straight edge is 8 feet 3 inches long. In operation the piece of wood on the end of the straight edge is placed on the rock or ground in the direction it is desired the water shall run, the other end is then shifted until the bulb in the spirit level assumes the level position. The straight edge is then on the line the drain should take so as to have the fall desired. The positions of the two ends should be marked by a daub of paint on the rock surface, or by a peg if in soil. After having ascertained one position in this way the next one is found by placing the lower end of the straight edge (that with the piece of wood on its under edge) on the place previously occupied by the upper end, and the first operation repeated. This is continued until the desired limits of the contouring have been reached. For this work on rocks it is desirable to have several straight edges of different lengths, some of them quite short, as the short ones are useful in places where the catchment is steep.

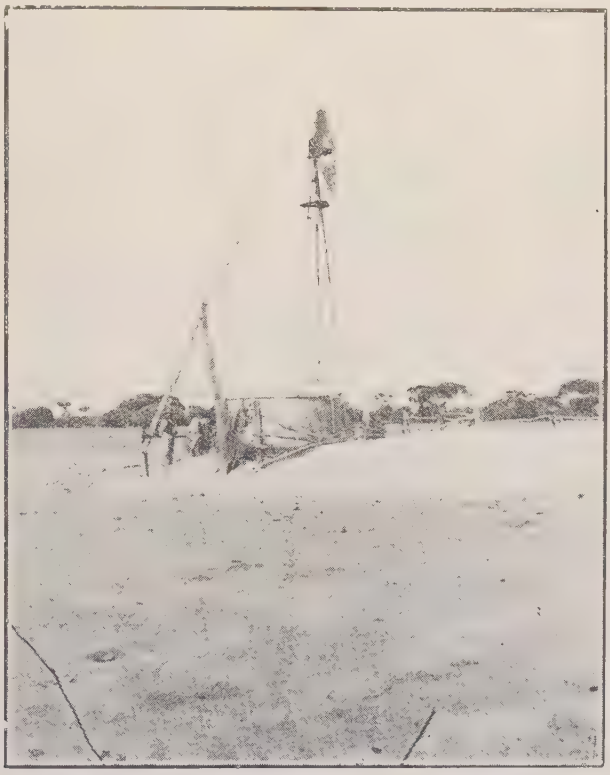
On soil catchments the levelling or "butt" peg should be driven in level with the surface, and a longer indicating peg put in alongside of it to guide the ploughman in ploughing the drains. As the "butt" peg is certain to be covered up in places, and the indicating peg will probably be knocked down. it is advisable to take two steps from the former, square off the line of drain on the down side, and put in a long peg, so that by taking two steps from this the "butt" peg can always be found even if covered up. The first furrow should be opened up on the far side of the drain, and the plough should not be run nearer than a foot or fifteen inches to the "butt" peg.

Autumn is probably the most suitable time for sinking the tank, but almost any time will serve provided the ground is not too wet, for ploughing can always be done, however dry it may be, with a proper plough and with the points of shares kept sharpened. A drain around the excavation will keep out surface water as long as provision is made for it to get away.

If the site selected contains a watercourse the tank is located preferably near, rather than on it, for when located on it there is always the risk that an unusual rush of flood water down the water course may damage the embankment, whereas if located near it the water can be diverted into the tank, and in flood time the water course itself will act as a "bye-wash" or "get-away," and the danger referred to averted. If there is a good fall on the site chosen for the tank the length of same should be at right angles to the direction of the fall and not parallel with it. If parallel with it the water in the lower end of the tank would reach the surface of the ground, when the depth at the upper end was very shallow, and thus much of its storage capacity would be lost.

Before commencing to excavate the tank a temporary drain should be ploughed out in a position that will prevent the water from running in to

the excavation from the intake to the tank. There is usually a thickness of surface soil that will not hold water, and as all tanks are required to hold water up to the level of the natural surface, and many of them above it, it is always advisable when ploughing to continue ploughing over the "cess" and for 8 or 10 feet under the seat of the embankment. All the surface soil



The ancient and modern methods of raising well water.

so ploughed is to be scooped off and deposited on the outer side of the embankment. This system has been adopted by Mr. W. N. Hedges, at Koolberrin, and the value of same is easily seen, as all the face of the embankment is built of good-holding soil, which merges on to the soil of like nature and forms a certain impervious embankment. The system of ploughing out a so-called puddle trench under the inner "toe" of embankment is useless, as, if the "cess" is not cleared of surface soil, then the surface soil from the "cess" is carried into the puddle trench by the scoop. The "cess" is the width of ground between the edge of the tank excavation and the bottom or "toe" of the embankment, and should be from 25 to 33 feet wide from the edge of the excavation to the "toe" of the inner slope of the embankment.

The excavated material should be placed neatly in the form of an embankment at the back and on the two sides. A well-built embankment, even if it does not enclose water, will protect the surface in the tank from evaporating winds. It should have four to one batters on the inside, be flat on the top, and wide enough for a horse and cart to drive on it. The slope on

the sides is known as the "batter," and its inclination is expressed by the relation which it bears in a horizontal direction to the vertical, thus a four to one batter rises one foot vertically in each four feet horizontally.

In order to offer as little surface as possible to the evaporating influences of the sun and wind it is necessary to have the sides as steep as can be managed. As these tanks are excavated with horse labour, the steepness of the batter of a tank excavation is governed by the width of the horse team. Even with horses only two abreast it is hard to get a batter less than two and a-half or three to one on the sides, nor is it advisable, as, if left too steep, it certainly will, when wet, run into the tank.

Owing to the necessity for covering tanks they should be long and narrow rather than square. The minimum width is determined by the width in which a team can work at the bottom and by the depth. The minimum working width is considered to be from six to nine feet. The dimensions and capacities of tanks which comply with this feature and with different batters are given hereunder:—

BATTERS 2½ TO 1 ON SIDES— 3 TO 1 ON ENDS.

	Feet.	Approximate Capacity. Cub. Yds.		Feet.	Approximate Capacity. Cub. Yds.
	9 FEET DEEP.				
Bottom ...	9 x 30		Bottom ...	6 x 36	
Top	54 x 84	666	Top	51 x 90	666
	10 FEET DEEP.				
Bottom ...	9 x 30		Bottom ...	6 x 36	
Top	59 x 90	848	Top	56 x 96	850
	12 FEET DEEP.				
Bottom ...	9 x 30		Bottom ...	6 x 36	
Top	69 x 102	1,284	Top	66 x 108	1,311
	14 FEET DEEP.				
Bottom ...	9 x 30		Bottom ...	6 x 36	
Top	79 x 114	1,896	Top	76 x 120	1,912
	16 FEET DEEP.				
Bottom ...	9 x 30		Bottom ...	6 x 36	
Top	89 x 126	2,644	Top	66 x 132	2,669

BATTERS—2½ TO 1 ALL ROUND.

	9 FEET DEEP.				
Bottom ...	9 x 30		Bottom ...	6 x 36	
Top	54 x 75	607	Top	51 x 81	612
	10 FEET DEEP.				
Bottom ...	9 x 30		Bottom ...	6 x 36	
Top	59 x 80	769	Top	56 x 86	777
	12 FEET DEEP.				
Bottom ...	9 x 30		Bottom ...	6 x 36	
Top	69 x 90	1,173	Top	66 x 96	1,189
	14 FEET DEEP.				
Bottom ...	9 x 30		Bottom ...	6 x 36	
Top	79 x 100	1,694	Top	76 x 106	1,721
	16 FEET DEEP.				
Bottom ...	9 x 30		Bottom ...	6 x 36	
Top	89 x 110	2,348	Top	86 x 116	2,387

BATTERS—3 TO 1 ALL ROUND.

	Feet.	Approximate Capacity. Cub. Yds.		Feet.	Approximate Capacity. Cub Yds.
9 Feet Deep.					
Bottom ...	9 x 30		Bottom ...	6 x 36	
Top	63 x 84	765	Top	60 x 90	774
10 Feet Deep.					
Bottom ...	9 x 30		Bottom ...	6 x 36	
Top	69 x 90	977	Top	66 x 96	991
12 Feet Deep.					
Bottom ...	9 x 30		Bottom ...	6 x 36	
Top	81 x 102	1,512	Top	78 x 108	1,536
14 Feet Deep.					
Bottom ...	9 x 30		Bottom ...	6 x 36	
Top	93 x 114	2,208	Top	90 x 120	2,246
16 Feet Deep.					
Bottom ...	9 x 30		Bottom ...	6 x 36	
Top	105 x 126	3,089	Top	102 x 132	3,143

When a surveyor's level is not available, the drains on the catchment area can be located with the aid of the straight edge and level as already described. They should be wide and shallow rather than deep and narrow, for in the former the flow is slower and there is little scouring. These drains should be cut out of the solid earth, with the soil placed on the lower side. The size of the drain should be governed by the size of the tank. Very often small drains, two or three furrows, are valuable as feeders to the main drain. Their minimum width at bottom should be one foot, with one to one batters and from nine to twelve inches deep. It is often convenient to make these drains with a quarter-yard scoop, in which case the width at bottom will be that of the scoop. Where drains curve they should be widened, the sharper the curve the greater should be the width, and when they meet the junction should be made at an acute angle. Drains should be kept clean, for unless this is done water from light showers will not reach the tank, and every shower is of importance. The subsidiary drains usually discharge into a wider main drain, but neither the subsidiary drains nor the main drain should discharge directly into the main tank. The water should first find its way into a very much smaller excavation, known as a settling or silt tank, which need not be more than five or six feet deep. This tank will prevent much rubbish and silt being carried into the main tank, and can be easily cleaned out each summer. From the silt tank the water should be conveyed to the bottom of the main tank by means of a flume, or by a wide drain which should extend to the bottom of the tank, and which should be pitched with stone to prevent erosion. This pitching is done by making an excavation the required width about eight inches deep, and filling it with large stones which are tightly wedged together by smaller ones.

The work connected with the tank is not completed until ample provision for the overflow is made; for this purpose a large drain known as a "bye-wash" is usually provided. Even in flat country this is important, or otherwise the ends of the embankment will be gradually eroded, and the protection which it affords from evaporating winds lessened. On level ground the need for a "bye-wash" may be obviated by pitching the ends of the embankments. A "bye-wash" is, however, absolutely essential when the tank is excavated on sloping country, and where the embankment is used to conserve water above the surface of the ground, for under such circumstances, unless a "bye-wash" of ample width is made, the embankment may be damaged or even swept away, and the work of many months destroyed, and much valuable water lost, in a few minutes. The "bye-wash" is obviously placed on the lower side of the tank or dam, and, if at all possible, should divert the overflow waters into a natural water-course. It is for this latter reason that it has already been recommended that tanks on sloping-ground should be located near one of these. The "bye-wash" should leave the tank in a wide sweep, should be well clear of the end of the embankment, and of ample width. It is safer, and therefore economical, to have it several feet too wide than one foot too narrow. The top should be at least one foot below the level of the lowest part of the embankment, so that the water will be diverted before it can flow over the edge and wash the earth embankment away; it should also be excavated out of the solid earth, and where the volume of water it has to carry may be considerable, even occasionally, it is necessary to pitch the sides and also the bottom.

It is not advisable to allow stock to have access to the tank, but it should be fenced off to protect it from them as well as from vermin. The needs of the stock are best provided for by means of a pump and troughing, or, where the situation is suitable, by a syphon placed over the bank to a trough and controlled by a ball tap. These methods will prevent pollution, much water will be saved, and the efficiency of the tank will be lengthened. Even when stock are to have access to the tank it should be fenced on the three sides and down the front so as to protect the sides from being damaged by them. Whenever a tank gets low, as much silt as possible should be cleaned out, in this way the depth will be maintained and much disappointment saved. It is not unknown for a farmer at the beginning of a dry spell to find himself with a few feet of silt and several inches of water, instead of several feet of water as he expected.

The conservation of water by means of excavated earthen tanks on farms has the advantage that the farmer, by using that adaptability which he is constantly called upon to exercise, can, if he so desires, carry out the work himself. It is done with the teams he is accustomed to drive, and the work of loosening the earth with a plough, and excavating it with a scoop, is not very dissimilar to other farm operations, though it may be a little harder than some. The farmer can, therefore, provide by this method ample water conservation to meet the needs of his stock with but little out of pocket expenditure.

Conservation of water is the urgent and special need of many farmers in the Eastern agricultural areas. Not only is it the key to the greater prosperity which is possible in these areas, but it is essential for the retention of a healthy, contented and happy community. Fortunately, there is no reason

to believe that there is any district in which insufficient rain falls to provide for ample requirements, but this needs to be conserved, and it is the duty of individual farmers to see that this provision is made wherever and whenever such is possible.

THE SHEEP BLOW-FLY PEST AND ITS CONTROL.

GEO. L. SUTTON,
Director of Agriculture.

For many years there has been on the market quite a large number of simple substances and mixtures for which it is claimed that sheep will be protected from blow-fly infestation for varying periods ranging even up to six and twelve months. As the result of the investigations which were commenced in New South Wales and Queensland in 1913, and continued in co-operation with the Commonwealth Institute of Science and Industry, it was found that of all the materials tried, the one which stood out as being of any value in dealing with the pest was arsenic, and that its use in a practical way afforded a protection from injury to the extent of at least 90 per cent.

Prior to this discovery attempts were made to control or exterminate the blow-fly on sheep runs, principally by means of traps, parasites, and deterrents. None of these proved, however, after exhaustive trial, to provide sufficient protection.

Simple and cheap traps were devised and proved most effective in capturing enormous numbers of flies, but not all of them; those that remained at large proved sufficiently numerous to attack and injure large numbers of sheep. These simple traps are, however, extremely useful for minimising the blow-fly trouble around the homestead.

Several parasites were discovered and experimented with. The Entomological branches of this and other States have reared and distributed enormous numbers (running into millions) of these parasites, which must have had, and probably will continue to have, a controlling effect upon the number of blow-flies produced, but in spite of these natural enemies there are still sufficient blow-flies produced, even in districts where the parasite is native, to cause immense loss as the result of sheep being fly-blown.

Several compounds containing strong smelling substances like carbolic, creosote, etc., and which are known to be objectionable to blow-flies, have been and are being tried. These, however, have proved entirely unsatisfactory, and it is not very surprising, for the natural instinct of the female fly to preserve her species is so strong that when full of eggs or larvae she will, in the absence of carrion and in the presence of sheep, deposit them upon the latter.

Arsenic, however, provides effective protection, mainly because it acts as an internal poison both to the adult blow-fly and its larvae. To be effective it is therefore necessary to be present amongst the wool, so that when obtaining food from this source they will also obtain sufficient arsenic to poison them. This can be achieved by treating the wool with a solution of arsenic in any convenient way, such as by the usual process of "dipping" sheep. Such a plan does afford protection, as a good proprietary arsenical dip contains about .2 per cent. of arsenic in solution, and this is about twice as strong as is necessary to kill the blow-fly or its larvae. Unfortunately, however, as experience has proved, "dipping" the sheep affords protection for only a limited period of about a fortnight or three weeks, therefore, to afford such a lengthened protection as is necessary, ordinary "dipping" would require to be repeated too often to be practicable. Fortunately, it was learnt in 1916, through trials conducted at Orion Downs Station, Queensland, with Cooper's Sheep Dip, that protection for a much longer period could be obtained by using a solution of quadruple strength. To immerse sheep in such a strong solution was known to be dangerous, but as the majority of sheep are at-

tacked by the blow-fly on the breech, the strong solution was applied to that part of the wool only. It was found that this method gave at least 90 per cent. protection for a comparatively lengthy period. The method adopted at Orion Downs was then tried at the Gindie State Farm, Queensland, with similar results, and in 1918, under the co-operative scheme of investigation, it was again used at Dalmally Station and its efficiency confirmed. It was there found to be nearly perfect, the losses at Dalmally being practically nil, while serious losses occurred at certain stations in the surrounding district where the sheep had not had a strong solution of "dip" applied to the breech.

The dipping solution used so successfully contained about 0.8 per cent. of arsenic, as well as sulphur and other ingredients usually found in good sheep dips. With a view to lessening the cost of the treatment it was important to learn whether its efficiency was due to the arsenic or to one of the other ingredients, or to a combination of them. Experiments in this connection subsequently proved that the lengthened protection was due to the arsenic in the solution, and, further, that much stronger solutions containing up to 1.5 per cent. (or 15 lbs. arsenic per 100 gallons) could be used when applied to the breech, and without any ill-effect either upon the sheep or the wool. It was found, however, that a solution containing about 0.7 per cent. arsenic (7 lbs. of arsenic per 100 gallons) was quite as efficient as the higher percentages. Weekly analyses of the wool taken from the breeches of the jetted sheep showed that the amount of arsenic in same decreased from the day the sheep were treated, until at the end of three months there was insufficient left in the wool to poison the blow-fly or its larvae, even when using the largest quantity of arsenic, thus defining the period over which protection can be secured.

Since the co-operative experiments were concluded the method which gave such satisfactory results has been tried commercially in the other States as well as in our own, with equally satisfactory results. It consists of a solution containing from .5 to .7 per cent. of arsenic applied to the breech wool of the sheep, not throughout the year, but usually about a month before lambing or at any period when the blow-fly attack may be expected. This solution is made according to either of the following formulæ, which are just as effective but cheaper than sheep "dipping" powder of quadruple strength. Unless desired for other reasons it is not necessary to crutch the sheep before applying the solution.

Formula 1.	Formula 2.	Formula 3.
13½ lbs. arsenate of soda. 100 gallons water.	7 lbs. washing soda. 7 lbs. white arsenic. 100 gallons water.	3½ lbs. caustic soda. 7 lbs. white arsenic. 100 gallons water.

The white arsenic specified in the formulæ is the commercially grey arsenic which is at least 90 per cent. pure. The arsenate of soda is also the commercial article which is usually about 95 per cent. pure.

Formula No. 1 is made up by dissolving the arsenate of soda in four gallons of water, and then adding this strong solution to sufficient water to make 100 gallons.

Formulæ 2 and 3 are made up by first dissolving the washing soda or caustic soda in four gallons of boiling water, and then, whilst still boiling, adding the white arsenic and stirring. When dissolved, the solution in each case is diluted to make 100 gallons.

When compounding these formulæ care should be taken not to inhale any of the fumes or vapour rising from the boiling mixture, or the dust from the dry powder, as they are both poisonous. Care should be taken also to keep these poisonous mixtures out of the way of animals, and also label them "Poison."

As sheep are usually treated to prevent blow-fly injury when they are carrying wool of fair length, the more wool the better, and it is desirable that the solution should reach all the wool right through to the skin, the practice adopted, when large numbers of sheep are to be treated, is to use a fine jet through which the solution is driven on to the wool and right up to the skin by means of a pump working under a pressure of from 125 to 175 lbs. to the square inch. Because the solution is applied by means of a "jet," the method is known as "jetting."

At the Government Sheep Fly Experiment Station, Warrah, New South Wales, the power is supplied by a plant costing about £100. It was found that working at a pressure of 125 lbs., using a nozzle with an opening 1/16th of an inch, fitted with an "Edzell" cut-off, about 60 gallons of solution were required to jet 300 sheep, and that about 2,000 sheep could be treated by a careful man in a day of eight hours. It was also found desirable that the operator should protect himself from the solution by smearing his face and hands with some vegetable oil, such as cocoanut or castor oil, and by wearing motor goggles.

On small holdings with, say, 500 sheep or under, an expensive or elaborate plant is not necessary. The sheep, especially the ewes, which are in most danger, can be mustered periodically, crutched and swabbed with the solution of arsenic made in accordance with either of the formulæ given, or, if desired, a spraying outfit such as is used in small orchards can be used.

"Jetting" is a preventative treatment and not intended for sheep already blown; these should have the wool shorn from the affected parts, the maggots destroyed, and the wound dressed with some oil or emulsion. Kerosene, petrol, or turpentine will readily kill the maggots, but for application to the wounded surface are preferably diluted with a bland oil like sweet, olive, or castor oil; a useful oil dressing for these and wounds is made by mixing castor oil with three per cent. of carbolic acid. An emulsion which will afford protection for a more lengthy period than the applications referred to contains the following ingredients:—

1 gallon crude castor oil;	1¼ lbs. common hard soap;
1 gallon water;	2 ozs. arsenate of soda.

This is prepared as follows:—Dissolve the soap in three quarts of hot water by boiling; next dissolve the arsenate of soda in about a pint of boiling water, and add this to the hot soap solution, and make up to one gallon with water; finally add the castor oil to the hot soap mixture, and stir or agitate violently for 10 minutes. It will then form a complete emulsion ready for use, and should be applied by swabbing to the parts to be treated. It affords longer protection not because it will repel the blow-fly, but because, like the "jetting" solution, it will poison the blow-fly or its larvæ after the attack.

In conclusion it is emphasised that treatment with arsenic does not prevent the blow-fly from attacking the sheep, nor does it aim to do this. However, it does provide successfully a poisonous environment on those parts of the sheep most likely to be attacked, so that when the adult flies or their larvæ, dropped or produced from eggs deposited there, obtain their food, sufficient arsenic will be taken to destroy same before they can injure the sheep.

THE "JETTING" SYSTEM AT "KOOLBERIN."

W. N. Hedges,
"Koolberin."

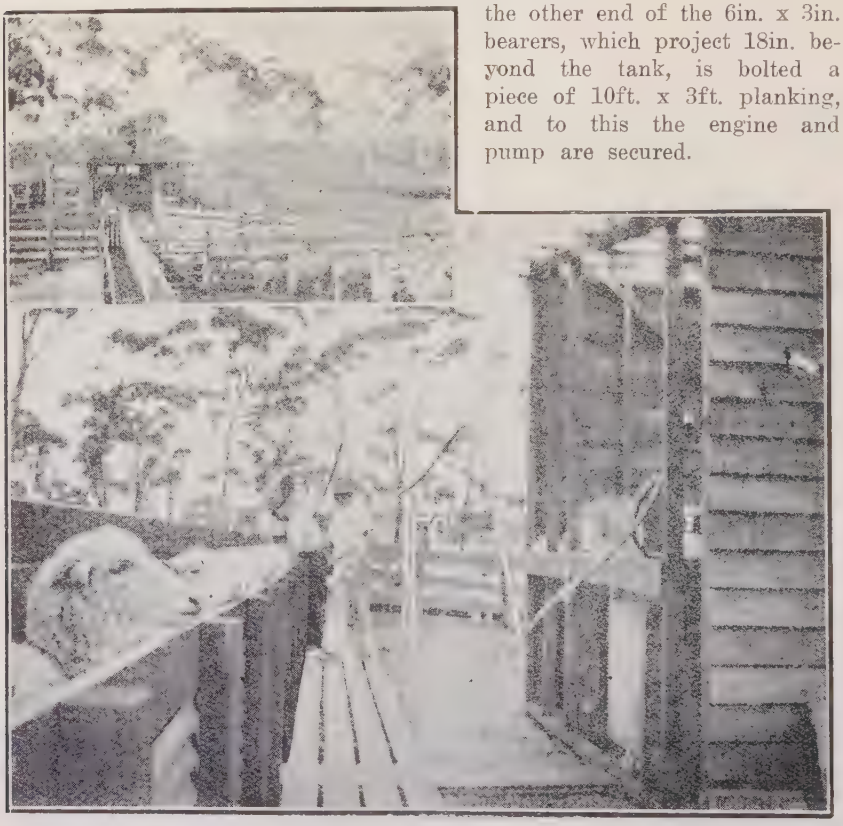
Prior to the installation of the jetting plant in 1913, the blow-flies caused very considerable trouble with the lambing ewes. After carefully considering the question it was decided to jet the sheep with a sheep-dip four times the usual strength in order to control the blow-fly pest. As far as the working of the system is concerned, it has proved a huge success, and since its installation there has been no trouble with blow-fly infestation.

The jetting race is so constructed that the back of it is close boarded and is higher than the front. The front has a sheet of galvanised iron, with one board at the top, the iron being lapped in such a way that the wool of the sheep does not catch in the joints. The iron is used to protect the man from the spray. The details of construction may be seen from the illustration herewith.

The floor of the race on which the sheep run through is boarded with battens which are about half an inch apart, and has cross battens nailed on it. Under the race on graded boards is a tray made of galvanised iron with a three-inch fall from each end to the centre where a cross gutter is put in about 12in. wide and 3in. deep, which carries the surplus solution into a sump constructed by sinking a large cask into the ground. The tray should be hosed quite clean at mid-day and at night with the same pressure as used on the sheep. The cross drain from the race terminated about 6in. over the side of the cask, and a movable strainer is then put in so that the liquid is strained. The strainer can be lifted very quickly as it stands on two fillets. It is 12in. square with sides made of about 3in. x 1in. wood with mosquito-netting nailed underneath, and can be cleared of any *debris* which it collects by taking out and turning the bottom upwards and giving it a slight knock.

The cask is let in in such a position that the suction pipe from the engine can be dropped into it, but it has been found better to take out a few bucketsful occasionally from the cask and put it in the tank, and continue jetting from the latter. The pump is very complete with pressure gauge and also an automatic release valve, which can be set to any desired pressure. It is worked up to 175 to 200 lbs. pressure by a small petrol engine, and will work up to 300 lbs., but it was found that about 175 lbs. was ample. A Bordeaux nozzle is used.

When fixing the engine a 200-gallon tank was placed in a suitable position with a piece of 6in. x 3in. timber running along each side near the top, and projecting past the tank about 5ft. at one end and 18in. at the other where the engine is fixed. These two pieces of timber are bolted to the posts of the stand, and the ends, which project five feet, have small joists laid across them to carry the boards which form a platform just above the level of the tank. On this platform there is ample room for mixing the dip and keeping it ready for use. On the other end of the 6in. x 3in. bearers, which project 18in. beyond the tank, is bolted a piece of 10ft. x 3ft. planking, and to this the engine and pump are secured.



There are two high posts erected at each end of the race. One pair of these can be seen in the illustration. Fencing wire is run through each of these posts at a height of about 9ft. 6in., and on each wire there is a small ring about 3in. in diameter. The hose is hooked up to the rings by binding thick string round the hose forming a loop into which a wire hook connects to the rings. The inner post is in such a position that the right length of

hose is allowed to hang somewhat the same as from a shearing machine. Each post is set 12in. out of plumb against the strain. As the result of this arrangement, and as may be seen from the illustration herewith, the man using the jet has no weight on his arm, and the hose travels backwards and forwards without requiring the slightest attention.

The small crush pen at the end of the race holds just enough sheep to fill it. Battens are placed on boards in the crush pen, which is boarded so as to prevent the sheep carrying dirt with their feet into the jetting race, and the outlet end of the race is so arranged that any sheep which are found to require special attention can be drafted out. The whole lay-out has worked splendidly; the solution penetrates right into the skin of the sheep, and the average number of sheep jetted from its installation has been six per minute, including the time taken for emptying and filling the race.

There may be other systems of "spraying," and it is certain that for a larger number of sheep two races placed parallel to each other with only sufficient room between for the man to work would be advantageous, and would provide for efficient and more expeditious working. The provision of two races would enable one race to be filled whilst the sheep in the other were being "jetted," and thus a very large number of sheep could be dealt with in a day.

Since the plant was installed in 1913 there has not been the slightest alteration or addition made to it, nor has it been necessary to spend anything for maintenance or renewals. The year prior to the installation three men were continually working amongst about 700 ewes at a time when they should have been left as quiet as possible. Since that time, as the result of carefully spraying the ewes with a strong sheep-dip well up over the tail and down the breech, about three weeks before lambing, there has not been the least trouble with over 2,000 ewes lambing annually. The operation is harmless to the ewes and is very quickly carried out, as quite 4,000 to 5,000 can be sprayed in one day with only one race 60 feet long.

BLUE MOULD ON ORANGES.

W. M. CARNE, F.L.S.

The greatest cause of financial loss to the citrus industry in this State is the wastage resulting from Blue Mould. It may be safely said that Blue Mould is the factor which decides whether the exporting of oranges is profitable or not. Indeed, one may go further and say that the development of the citrus growing industry is checked more by Blue Mould than by any other factor.

It must be again emphasised that Blue Mould follows injury to the skin of the orange. Careful handling, the packing of dry fruit, and its dry storage when packed are the principal means of reducing Blue Mould wastage. There are, however, factors which render difficult the attainment of these ideals. Firstly, our oranges are picked during the wet season, and proper sweating in the packing sheds is frequently difficult if not impossible. Wastage increases rapidly under moist conditions, for slight injuries, which might escape infection under dry conditions, are readily infected when the conditions are moist. Secondly, owing to the limited number of ships and the uncertainty of their arrival packing of large consignments for export must be commenced weeks before shipment, or be rushed through in a few days. In the former case wastage often sets in before the fruit leaves the orchard, and in the latter there may not be time for sweating, and there is a strong tendency for rough and careless handling. Lastly, and probably the most important point of all, is the fact that oranges grown on the coastal plain develop a fine delicate skin. Experience has shown their great liability to injury and mould. Oranges from the Darling Ranges have coarser skins and richer colour and are less liable to this wastage. This variation of the fruit from different districts is not peculiar to this State, but has been noted in South Africa and the United States.

The following notes on Blue Mould wastage in Florida have been taken from a bulletin published by the United States Department of Agriculture. They show how the problem has been solved in Florida, and confirm the fact that a sound, clean, unbruised skin will effectively protect an orange from Blue Mould:—

Excerpts from Bulletin of U.S. Department of Agriculture.

FACTORS GOVERNING THE SUCCESSFUL SHIPMENT OF ORANGES FROM FLORIDA.

Keeping Quality of Florida Oranges.

The keeping quality of the orange is naturally good. Since the life processes of the fruit continue after it has been severed from the branch, there is a prolonged period during which an uninjured orange remains sound and free from all decay. Ultimately, when the life span has been run, the tissues die and decay follows even in uninjured fruits. The delay is long enough, however, to allow the average fruit to be packed and placed on the market and to reach the consumer in sound condition.

Heavy Losses from Decay in Commercial Shipments.

The losses from decay during transit have been very heavy in the commercial shipments of fruit, and the experimental work of the Bureau of Plant Industry was undertaken in Florida in response to the many requests for advice and assistance which came to the Department of Agriculture. It is difficult

to estimate what the actual loss from this cause has been during past seasons. Several reliable commission men who handle large quantities of Florida oranges each year have stated that averaging the good with the bad years probably 10 per cent. of the fruit decayed before reaching the consumer. Experimental shipments made under the direction of this Bureau indicate that the loss may have been fully as heavy as this.

Since Florida's orange crop averages 4,000,000 or 5,000,000 boxes per year, the decay of 8 or 10 per cent. of this fruit entails an annual financial loss of at least half a million dollars. Ten per cent. of 4,000,000 boxes amounts to 400,000 boxes, on which the picking and packing charges have been paid, with approximately 50,000 dollars spent for box material alone. The freight charges represent something like 200,000 dollars, and these amounts, together with the cost of repacking what is left, bring the total loss high enough to seriously endanger the welfare of the industry.

Reputation Injured by Decay in Transit.

Unfortunately the financial injury is not confined to the fruit actually decayed. It is impossible to estimate the loss which has resulted to the industry from the bad reputation which Florida fruits have gained in trade. While it is difficult to discover how far the low prices occasionally received have been due to this cause, many fruit handlers in Northern markets condemn very strongly the poor keeping quality of the Florida orange and willingly admit their intention of using fruit of better keeping quality if they can obtain such from other points. The situation of the Florida orange grower would be critical indeed if it were not for the fact that fruit handled carefully shows so much less decay than does fruit picked and packed under careless commercial conditions.

History of the Department Work in Florida.

Investigations by the Department of Agriculture, having in view the discovery of the factors underlying the successful shipment of oranges from Florida to northern markets, began during the season of 1907. The work, which was planned along lines similar to those followed in the California investigations, included the determination of the character and type of handling employed in the various operations of preparing fruit for shipment and the discovery of the relationship between present methods and the occurrence of decay. The object of the work of the department was to suggest changes in the industry which should reduce the immense annual financial losses of the Florida growers by enabling them to market their fruit in sound condition.

The first researches in Florida were conducted by Mr. L. S. Tenny, who devoted his attention to an inspection of the work done by various picking crews and individual pickers, as well as to the character of work being done in the packing houses. It required only a short time to indicate that what had previously been found to be the case in California was also true in Florida, viz., that the fruit was receiving considerable injury in the course of its preparation for shipment. Conditions were, if anything, somewhat more exaggerated, owing to the fact that the thin-skinned, juicy Florida orange is of a more tender type and is more easily injured, and the bulk of the handling which would enable Californian oranges to go through the various picking and packing operations without injury is not safe for the Florida product. The importance of avoiding dropping or puncturing by long stems is most urgent when dealing with thin-skinned, juicy fruit. The necessity of handling with extreme care so perishable a product as the Florida orange cannot be too strongly emphasised.

After the determination of the character of work being done and the discovery that considerable injury was being inflicted on Florida fruit, the investigations were so planned as to determine whether it was practicable to handle the fruit with sufficient care to prevent injury. At first demonstrations corresponding to those carried on in California were made in the packing houses, using fruit selected for soundness and similar lots showing injuries of various kinds. The effects of dropping the fruit and of washing it to remove sooty mold, were also demonstrated. These lines of work prove conclusively that Blue Mold develops wherever the skin of the orange is injured in any way, and that dropping is followed by serious decay, especially when the fruit

falls into a receptacle containing dry twigs, gravel, splinters, or other matter rough enough to bruise or puncture the skin.

After the packing house demonstrations, showing that sound, uninjured Florida oranges are not affected with Blue Mould decay, shipping experiments under commercial conditions were undertaken. These experiments consisted of forwarding boxes of fruit of known history to Washington, where the percentages of decay were carefully determined on the day of arrival and after one, two and three weeks, the fruit meantime being held under ordinary open market conditions.

These experiments were followed during five successive seasons, thus enabling the investigators to determine the effect of seasonal influences. The data obtained during 1910-11 and 1911-12, when the work was undertaken on a more extensive scale than in the former seasons, corroborated the early results without exception, and the carrying quality of the Florida orange when packed and shipped in sound condition was proved to be as good as that of the California product. An injured orange, whether grown in California or in Florida, will decay whenever the conditions for the development of Blue Mold are favourable. A sound orange in good, healthy condition, whether grown in California or in Florida, is able to resist Blue Mold decay.

Blue Mold Decay of the Orange.

Indications of decay—the characteristic appearance of the orange decayed by Blue Mold—is too well known to need description. Every handler of citrus fruits knows Blue Mold, which is by far the most common form of decay. The grower frequently sees it in the oranges hanging upon the trees, when the fruit has split or has been injured by thorns or twigs. He finds it in the fruit which has dropped to the ground. The packer sees it in the cull pile or in the boxes of fruit left standing in the house for a few days. The receiver of the fruit finds the decay as the boxes are opened, and frequently he smells it before removing the covers.

The first indication of decay is a small area of soft tissue at some point on the surface of the fruit. This increases rapidly in extent if the weather is moist and warm, and within a day or two a bluish or greenish spot develops. If weather conditions continue favourable, the entire fruit is rotted within a few days and the surface is generally coated with a bluish or greenish blue mat or powdery covering.

Blue Mold Fungus.

Blue Mold decay is caused by the growth of a minute organism within the tissues of the fruit. Laboratory experiments have shown this organism to be a fungus of the genus Penicillium, which includes the familiar blue mold or mildew on bread, on the surface of canned fruit, and on other vegetable matter. Growth takes place within the orange, the bluish mat on the skin being composed of the fruiting bodies made up by chains of spores, massed together in great numbers. The fungus is spread by means of these spores, which, like the seeds of many higher plants, germinate and grow as soon as they find lodgment under conditions favourable for their development. They require heat and moisture, and when these are present growth proceeds at a very rapid rate. The Blue Mold fungus has not the power to penetrate the sound living tissue of a well-grown fruit: hence, there must be a break or an abrasion of some kind in the skin, through which the disease may find an entrance. When growth has once started, even in a small way, the fungus is capable of killing the surrounding tissues and thus producing material on which to grow. This process continues until the entire fruit is destroyed. If, therefore, a fungus spore is present and lodges in an injured spot, the initial step toward decay has been taken, and if the temperature and moisture conditions during the next few days are favourable, the development of the fungus proceeds rapidly and the orange is almost sure to rot. Many experiments have been made in California and Florida packing houses in placing spores on fresh injuries, and, without exception, the characteristic decay has resulted. On the other hand, large quantities of fruit have been held under weather conditions most favourable to the development of decay, and the results prove that fruit which has been so carefully handled as to preserve the skin in an uninjured condition

shows practically no decay even when the surface has been purposely covered with spores. The development of decay is most rapid during warm, moist weather: fruit packed during a cool, dry period frequently reaching the market without much waste even though injuries are present. Under changed atmospheric conditions, the same fruit may arrive in a badly decayed condition. During an average Florida winter there are usually periodical warm spells. Reports of general heavy decay at the market end can almost without exception be traced to fruit packed and shipped during these warm periods.

With this understanding of the nature and cause of the most common form of decay, it becomes easy to see how the harvesting and handling methods may have an important bearing on the keeping quality of the fruit. If these are such as to break the skin or injure the orange, even slightly, favourable conditions for the development of Blue Mold decay exist, and such decay is almost certain to result, as observations have shown that the spores of the Blue Mold are present practically everywhere. It is safe to say that most of the decay occurring in Florida oranges while in transit is due to Blue Mold. There is some loss in transit from decay due to other forms of rot, and this is usually very slight as compared with the loss from Blue Mold.

Causes of Blue Mold Decay.

Since the principal means of securing oranges of good keeping quality is by eliminating mechanical injuries to the fruit, and occurrence of decay is, therefore, closely connected with the handling methods in use in the grove and packing house.

Thorn punctures, which are made while the fruit is still on the tree, are among the first injuries to which citrus fruits are subjected. These are generally unavoidable, as during every wind storm a certain percentage of the fruit is injured by being blown against thorns. The puncturing which occurs when the fruit is being picked may be prevented, however, although it is frequently difficult to handle the oranges with sufficient care to avoid pressure against thorns or dried twigs when these are present in large numbers. Fruit is often bruised when the ladder is placed carelessly in the tree or when the sack is allowed to strike, or is pressed against the branches or ladder. Moreover, filling the field boxes so high that the fruit projects above the top will result in crushing the oranges when the boxes are stacked one on top of another. The oranges may be bruised on their way from the grove to the packing house by being jolted over rough roads in springless wagons. The driver of each wagon should be given a specially prepared seat and not allowed to sit upon the fruit.

Among the most common forms of injury may be mentioned scratches made by the finger-nails of the pickers and packers, each of whom should be required to wear gloves. It is comparatively easy for packers, especially if their finger-nails are long, to seriously injure a large percentage of the oranges which they handle. Some packers also do a great deal of harm by dragging the oranges around in the bins and by tossing the off sizes into the neighbouring bins. Abrasions due to the presence of gravel, twigs, splinters, protruding nails, or other foreign matter in the picking receptacles, field boxes, or packing bins may have far-reaching consequences.

Bruises caused by dropping the fruit in the various stages of picking or packing have been found to cause serious loss from decay. There are a number of places where oranges may be greatly damaged by dropping. First of all, the picker may toss them carelessly into his picking basket or bag. Careless pickers frequently throw the oranges into the open receptacle by means of a shove with the clippers, the fruit sometimes falling as far as three or four feet. Serious damage may also result from emptying the fruit roughly into the field box. The bag or basket may be held too far above the box and the fruit allowed to fall too great a distance. In case the bottom of the box is covered with twigs or small pieces of dirt the injury is greater. A sack which opens only at the top and from which the fruit must be poured into the boxes is likely to cause severe damage because of the bumps to which the fruit is subjected. Usually no greater care is observed when emptying the fruit into the field box and from that into the hopper of the washer, grader or sizing machine. The washing machine provides excellent opportunities for the infliction of mechanical injuries and for infection from dirty water. This phase of the subject will be discussed later.

Decayed fruit and trash should not be left in the boxes or allowed to accumulate on the floor and under the packing bins. The slightest breeze will scatter great quantities of blue mold spores from these rotted oranges over all the fruits in the house. A clean, well lighted packing house greatly diminishes decay by reducing the chances of infection. It has a beneficial influence on the workmen as well, offering a great incentive to better work. Moreover, a clean packing house is a good indication of the character of work being done throughout and indicates whether genuine efforts are being made to improve the methods of handling.

The hopper into which the fruit is emptied has always been the source of much injury to citrus fruits in Florida. In the old style of packing house, existing before the work of the Bureau of Plant Industry was begun, the hopper was frequently large enough to hold a wagon-load of fruit. Few, if any, of these are now in use. Even the more desirable small hopper was constructed with such a steep gravity run that the fruit was subjected to a severe bump on reaching the bottom. In going through the machinery or over the grading table other chances for injury occurred, and the final drop into the packing bin was sure to add several bruises. The desirable hopper has padded sides and allows the fruit to be emptied gradually by means of moving belts, which carry the fruit to the washing machine or grading belt: it is not necessary for the fruit to fall by gravity at any stage of its journey.

The most serious form of injury, however, is made by the clippers in removing the fruit from the tree. These clipper cuts are not as prevalent in Florida oranges as was found to be the case in the Californian fruit, for the reason that the Florida oranges are round and do not have the depression at the stem end which exists in the Washington Navel. Nevertheless, enormous damage has been done to the Florida fruits either by cutting the skin near the stem end when severing them from the branch or by puncturing them with the points. It is essential to have the ends of the clippers rounded or blunted in order to eliminate the possibility of piercing the fruit.

The presence of long stems on the oranges may be reckoned as equally disastrous. For this reason, in determining the character of work being done by a picking crew or individual picker, long stems are included as imperfections. A long stem is just as serious, if not more dangerous, than an orange which has been injured in some way; the latter decays, but this rot seldom affects a neighbouring orange; whereas a long stem has ample opportunity to injure a number of fruits in their progress from the tree to the packing bax. A sharp ragged fragment of stem projecting from the orange will injure all the fruit with which it comes in contact in the picking bag, field box, brusher, washer or packing bin. When it is considered that long stems are probably the most common imperfections found in the work of the Florida crews, the importance of giving particular attention to the picking becomes apparent. In most instances it is impossible to avoid leaving long stems, unless the so-called double cut is made. This means that the fruit is first severed from the tree with a stem half an inch long which is trimmed off when the fruit is held in the hands of the picker. This enables the workman to cut closely and carefully without danger of clipper cutting, and at the same time it prevents him from throwing or "shooting" the fruit into the picking receptacle. Actual experience shows that it requires very little more time to make the double cut, and when the picker becomes accustomed to clipping in this way he can operate practically as fast as with the old method, where he has to use care to prevent clipper cutting. Of course, it takes longer to make a careful double cut than to pay not the slightest attention to the character of the work performed. Since the picker is frequently unable to see the stem when the orange is on the tree, he consumes much time in adjusting his clippers in the right position. In making the double cut he is not concerned with the placing of his clippers, simply reaching out and severing the orange with a stem long enough to avoid contact between the fruit and the clippers; then when he holds it in plain sight he can easily make a smooth, close cut.

Evolution of the Florida Citrus Industry.

The results of the bureau investigations emphasise the importance of having the fruit arrive in market in good condition and of having it remain sound while in the hands of the wholesale and retail dealers. Shippers are frequently of the opinion that their interest in the condition of the fruit does

not extend beyond the percentages of decay found on arrival. It is realised that buyers can claim allowance for such decay, and consequently shippers are usually anxious to prevent it. In their opinion any decay which results after the fruit is purchased is the buyer's loss. This impression is erroneous, for the decay which develops after the fruit is in market is just as direct a loss to the growers and shippers as that which appears during transit. Although the direct shipper does not have to make a cash allowance for decay, occurring during the market holding period, brands which fail to remain in good condition lose their reputation and ordinarily do not command as high prices as do those which are known for their good market-holding quality. The wholesale and retail merchants want oranges upon which they can depend to remain in sound condition. For such fruit they are willing to pay a premium, while fruit which develops a high percentage of decay before it can be sold has nothing but its cheapness to recommend it. A grower or shipper who consigns carelessly or poorly packed fruit with the expectation that it will remain sound until it gets into market deceives no one but himself. He may be able to dispose of a few cars at fair prices, but the buyers soon learn what to expect and prices fall accordingly. Fruit which develops a high percentage of decay while in the market is the poorest kind of an advertisement, not only for the brand under which it is packed but also for the section of the State from which it is shipped.

In many cases growers and packers are anxious to do careful work, but they do not realise how many factors there are in the handling operations which may cause injury and therefore decay. They do not appreciate what careful handling means and they under-estimate its importance until the results are demonstrated to them. Injuries causing decay in citrus fruits while in transit and in market may occur from operations through which the fruit is put from the time it is taken from the tree until it is placed in the packing box. It is the prevention of these injuries in grove and packing house that makes up careful handling, and both grower and packer are concerned in knowing how they are caused and how they may be eliminated.

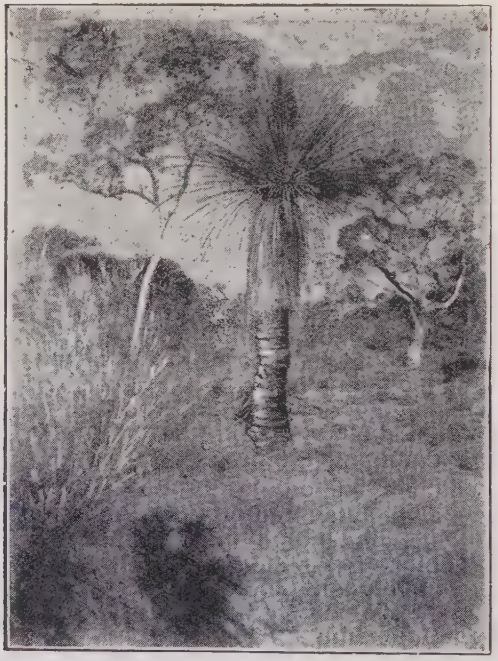
At the time the Department investigations were started the methods of handling Florida citrus fruits for shipment were extremely crude. Growers did their own picking, there was no uniformity of system, and the work was performed only indifferently well. These statements are not meant to reflect in any way upon the standing of the industry or to criticise the individuals who were concerned with the preparation of the fruit for market. Practically all of the imperfections were due to a lack of knowledge on the part of the growers and shippers and not to their desire to slight any of the important work. No one realised the effects of injury to the fruit, and few, if any, believed that injury was being inflicted. Growers and packers frequently greeted the Department workers with the statement that practically no injury was being done to their fruit, whereas later examination often showed 15 or 20 per cent. of their oranges to be injured in some way. The scattered nature of the industry was largely responsible for the crudeness with which the work was carried on. The old neighbourhood competition in the production of high-grade, attractive fruit, disappeared after the freeze, when the plantings were distributed so widely over central and southern Florida. Groves were more or less isolated, and a grower was frequently wholly ignorant of the type of work being done by other producers of citrus fruits.

When the department investigations were begun it seemed almost hopeless to expect that the results of the work could be made effective. The importance of getting in touch with every grower and shipper was realised from the start, yet without some central organisation through which these individuals could be reached, it seemed impossible to expect that improvements in the methods of handling could be inaugurated.

The changes which have taken place in Florida during the past five years are truly remarkable. The old type of packing house has almost entirely disappeared. Modern houses, equipped with the newest machinery for handling fruit properly, have been constructed in practically every citrus district in the State, so that at the present time the industry is practically well provided with the mechanical appliances for doing good work. The attitude of the growers and packers has changed more slowly, however. The Department has conducted a large number of field demonstrations in order to educate pickers to the necessity of careful work, and although much has been accomplished in this line,

much still remains to be done. The introduction of better handling methods is largely a business problem. It has to do with the re-organisation of the forces of workmen and with the method of paying them rather than with discovery of the cause of a particular form of decay.

In California the occurrence of injury in preparing the fruit for shipment was associated with the way in which the work was done. The pickers were paid by the box, and naturally each man was ambitious to pick as many boxes as possible during the day, irrespective of the character of his work. A premium was thus placed on rough handling. Several large companies, employing hundreds of men, demonstrated that by changing from the box-payment to the day-payment plan and by insisting upon careful work they could practically eliminate all picking injuries. A change in the plan of payment is not, in itself, sufficient to bring about better work, however; the workmen must be properly organised and supervised, and each individual picker must be held responsible for the character of his work. In California change from the individual grower doing his own picking to the plan of the Association picking crews, resulted in very great improvement in the character of the work. The same plan has more recently been carried out in Florida with very beneficial results.



WHEAT EXPERIMENTS AT THE CHAPMAN EXPERIMENT FARM.

I. THOMAS, Superintendent of Wheat Farms.

DEPTH OF PLOUGHING EXPERIMENT.

The soil on which this experiment was carried out was of a red sandy loam from which jam and wattle trees had been cleared some years previously.

The plots were ploughed with a mouldboard plough to depth required for the experiment early in August, and were cultivated with a "Springtyne" during spring and again prior to planting, and they were in splendid order when planted.

The seasonal rains commenced on 11th May, and the plots were planted on 13th May with "Nabawa" at the rate of 45 lbs. seed per acre, with an application of 90 lbs. of superphosphate (22 per cent.) per acre.

The area of each plot was half an acre, one-eighth being cut for hay and three-eighths left for grain.

The results obtained this year, together with the average yields to date, are shown in the tables hereunder. Before the plots reserved for grain could be harvested they were destroyed by fire, and no results were therefore obtained. The average yields obtained in previous trials are, therefore, shown:—

DEPTH OF PLOUGHING EXPERIMENT.

CHAPMAN EXPERIMENT FARM—1924

Variety, Nabawa. Planted May 13th. Seed, 45lbs. Superphosphate, 90lbs.

HAY YIELDS.

Depth of Ploughing.	Computed yield per acre.	Percentage yield.	Average yield to date, 1914-1924 (11 years).	Percentage yield 1914/1924 (11 years).
	cwts. qrs. lbs.		cwts. qrs. lbs.	
4in.	33 1 20	97	25 0 11	100
6in.	34 1 12	100	25 0 4	100
8in.	37 1 4	109	26 1 22	106

GRAIN YIELDS.

Depth of Ploughing.	Average yield 1915-1923 (9 years).		Percentage yield, 1915-1923, (9 years).
	Bushels	lbs.	
4in.	15	45	101
6in.	15	52	100
8in.	16	33	107

It will be seen by the above tables that the results of this year confirm those obtained in previous years, namely, that although the increase due to the deeper ploughing is not great it tends to improve the yield on the lighter soil rather than decrease it.

WHEAT VARIETY TRIAL.

This experiment was carried out on one of the first fields cleared on the farm. The soil was a light sandy loam, and is what may be described as fair quality "Jam" land.

The ground was prepared for this planting by being ploughed 4 inches deep during August, cultivated with the "Springtyne" cultivator during October, and again in March prior to seeding. It was then in good condition.

There were 11 varieties under trial, the variety "Gluyas Early" being used as the control. The seeding was done during the third week in May. The rate of seeding for the various varieties was 45 lbs. per acre, and superphosphate (22 per cent.) was applied at the rate of 90 lbs. per acre.

The area of each plot was ⅛ of an acre, each plot being repeated eight times, three being harvested for hay and five for grain. The hay plots were harvested during the last week in September, and the grain plots during the last week in November.

The results obtained for this year, together with the percentage results of last year, are shown in the tables hereunder:

CHAPMAN EXPERIMENT FARM.

VARIETY TRIALS 1924.

Planted May 18, 19, 20. Seed, 45lbs. Superphosphate (22%) 90lbs.

HAY YIELDS.

Variety.	Computed Yield per Acre.									Average, 1924.			Percentage, 1924.	Percentage, 1923.
	Section 1.			Section 2.			Section 3.							
	cwts.	qr.	lbs.	cwts	qr.	lbs.	cwt.	qrs.	lbs.	cwts.	qr.	lbs.		
Gluyas Early ...	39	1	4	42	1	4	33	2	16	38	1	20	100	100
Nabawa	23	2	0	24	0	16	21	1	12	23	0	0	60	87
Yandilla King ...	23	0	24	22	1	20	20	0	0	21	3	12	56	96
Nungarin ...	36	2	0	39	2	24	25	1	20	33	3	12	88	...
Dindiloa	36	2	24	39	3	4	25	3	12	34	0	16	88	82
Gluyas Early ...	41	2	16	43	2	8	30	3	12	38	2	24	100	100
Gresley	44	0	16	39	1	4	30	2	24	38	0	8	100	103
Comeback ...	43	0	8	34	0	0	31	0	24	36	0	8	96	86
Toby's Tusk ...	43	0	24	36	1	4	33	0	8	37	2	0	101	84
Merredin ...	44	2	8	33	2	24	29	1	20	35	3	20	98	88
Gluyas Early ...	43	2	24	33	0	16	31	1	12	36	0	8	100	100
S. H. J. ...	45	0	0	26	1	4	32	1	4	34	2	0	95	83
Florence	39	3	12	25	2	24	32	2	24	32	3	4	89	78
Gluyas Early ...	42	3	12	30	0	0	38	2	24	37	0	24	100	100

GRAIN YIELDS.

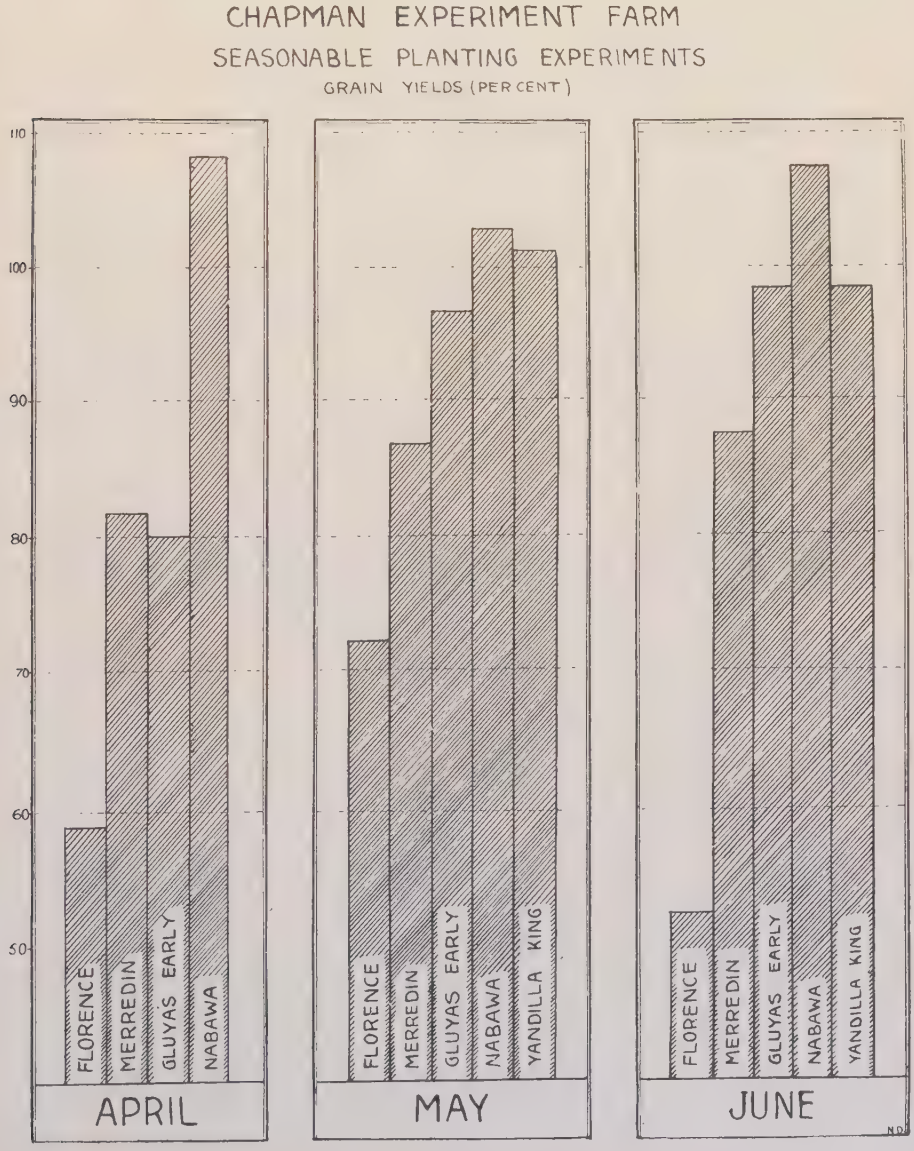
Variety.	Computed Yield per Acre.										Average, 1924.		Percentage, 1924.	Percentage, 1923.
	Sec. 1.		Sec. 2.		Sec. 3.		Sec. 4.		Sec. 5.					
	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.		
Gluyas Early ...	15	4	14	56	14	48	16	32	16	40	15	36	100	100
Nabawa	14	16	17	36	16	40	17	44	19	44	17	12	108	103
Yandilla King ...	12	40	14	16	14	48	14	0	14	56	14	8	87	105
Nungarin	16	0	16	16	16	8	16	8	16	24	16	8	98	...
Dindiloa	16	48	18	24	18	0	19	12	20	40	18	40	111	100
Gluyas Early ...	14	0	16	40	16	24	18	8	20	48	17	12	100	100
Gresley	15	20	18	16	18	40	19	4	22	8	18	40	108	118
Comeback ...	14	24	15	52	16	32	16	24	19	36	16	32	95	90
Toby's Tusk ...	16	32	17	12	18	24	19	52	21	44	18	48	107	102
Merredin	18	48	19	52	19	44	21	4	24	0	20	40	117	110
Gluyas Early ...	15	36	16	40	17	28	18	0	21	20	17	52	100	100
S. H. J.	16	8	16	32	16	40	17	28	18	16	17	4	96	86
Florence	12	32	12	48	13	36	13	52	16	24	13	52	77	76
Gluyas Early ...	17	12	16	56	17	4	19	44	19	44	18	8	100	100

This experiment has not been conducted long enough for reliable conclusions to be made, and in making comparisons of the yields obtained it is important to remember that the past season was an unusually late one, with good harvest rains after the middle of October, whilst in 1923 the harvest rains practically ended in September.

SEASONABLE PLANTING EXPERIMENT.

For some years past single row tests have been made to determine the most suitable time for planting the different varieties which vary with regard to their periods of maturity.

Observations indicated that these single row tests were not likely to give as reliable results as those obtained with field trials, and therefore it was decided to carry out, during the past season, a field trial with four varieties each representing a class with a different period of maturity. "Yandilla King" was chosen to represent the late maturing, "Nabawa" the midseason, "Gluyas Early" the early, and "Florence" the very early varieties. For control purposes the variety "Gluyas Early," planted in May, was used.



In the April and June plantings the varieties were planted in sections, with the control plots as the first and last of each section of six plots. Each plot was one drill width and one-eighth of an acre in area. Each section was repeated eight times, three being harvested for hay and five for grain.

The land on which the different plantings were situated was of a sandy loam typical of the Jam country. It had been prepared by ploughing 4in. deep during late July and early August, and cultivated with the "Springtyne" cultivator during spring and summer, and again prior to each planting. The control plots in the early planting in this way received an extra cultivation, as also did the plots planted in June after the control plots had been planted in May.

The rate of seeding in all cases was 45 lbs. per acre, and the superphosphate (22 per cent.) was applied at the rate of 90 lbs. per acre.

The results obtained are:

CHAPMAN EXPERIMENT FARM.

SEASONABLE PLANTING EXPERIMENT.

APRIL PLANTING.

Planted April 21, 1924. Seed 45lbs. Superphosphate (22 per cent.), 90lbs.

HAY YIELDS.

Date of Planting.	Variety.	Computed Yield per acre. Sec. 1.			Sec. 2.			Sec. 3.			Average Yield, 1924.		
		cwt.	qr.	lbs.	cwt.	qr.	lbs.	cwt.	qr.	lbs.	cwt.	qr.	lbs.
May 20	Gluyas Early ...	30	0	16	36	2	0	42	0	8	36	0	27
April 21	Nabawa	27	1	4	34	2	16	49	0	0	37	0	0
	Yandilla King ...	15	1	4	17	2	8	31	2	16	21	2	0
	Gluyas Early ...	32	2	8	30	0	8	42	3	12	35	0	16
	Florence	23	3	20	33	3	20	38	0	8	32	0	0
May 20	Gluyas Early ...	35	1	4	34	1	4	35	2	0	35	0	3

GRAIN YIELDS.

Date of Planting.	Variety.	Computed Yield per acre. Sec. 1.		Sec. 2.		Sec. 3.		Sec. 4.		Sec. 5.		Average Yield, 1924.	
		bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.
May 20	Gluyas Early ...	17	4	18	32	18	40	19	20	18	40	18	27
Apl. 21	Nabawa	20	16	18	16	18	32	17	4	17	44	18	24
	Yandilla King ...	11	12	9	44	11	12	8	24	10	16	10	8
	Gluyas Early ...	15	52	16	32	14	24	16	8	17	26	16	0
	Florence	12	16	12	24	12	32	14	24	14	16	13	12
May 20	Gluyas Early ...	18	32	18	16	17	44	19	20	17	52	18	21

CHAPMAN EXPERIMENT FARM.
SEASONABLE PLANTING EXPERIMENT.
June Planting.
Planted June 18. Seed 45lbs. Superphosphate (22 per cent.) 90lbs.
Hay Yields.

Date of Planting.	Variety.	Computed Yield per acre.									Average Yield, 1924.		
		Sec. 1.			Sec. 2.			Sec. 3.					
		ct.	qr.	lbs.	ct.	qr.	lbs.	ct.	qr.	lbs.	ct.	qr.	lbs.
May 20	Gluyas Early ...	35	1	20	39	2	16	30	0	8	35	0	8
June 18	Nabawa	18	2	24	15	0	16	18	2	24	17	2	0
	Yandilla King ...	19	3	20	18	3	12	20	1	20	19	2	24
	Gluyas Early ...	23	3	4	21	1	12	21	3	12	22	1	12
	Florence	15	1	20	17	0	24	16	1	20	16	1	12
May 20	Gluyas Early ...	37	2	24	37	2	8	39	3	20	38	1	20

Grain Yields.

Date of Planting.	Variety.	Computed Yield per acre.								Average Yield, 1924.	
		Sec. 1.		Sec. 2		Sec. 3.		Sec. 4.			
		bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.
May 20	Gluyas Early ...	20	24	20	48	15	52	20	0	19	16
June 18	Nabawa	22	48	24	16	21	52	20	48	22	24
	Yandilla King ...	22	40	23	4	19	20	19	4	21	4
	Gluyas Early ...	22	0	22	0	23	20	20	8	21	52
	Florence	16	40	15	52	14	32	15	36	15	44
May 20	Gluyas Early ...	24	24	19	44	22	40	21	12	22	0

The yields of the same varieties when planted in May (the same time as the controls), may be obtained from the Variety Trial results. For purposes of comparison the percentage yields of all plantings are as hereunder:—

CHAPMAN EXPERIMENT FARM.
SEASONABLE PLANTING EXPERIMENTS.
Percentage Results.

	Hay Yields.			Grain Yields.		
	April.	May.	June.	April.	May.	June.
Yandilla King	60	56	54	55	87	103
Nabawa	103	60	49	100	108	114
Gluyas Early	99	100	60	87	100	104
Florence	91	89	43	72	77	73

The better results obtained with the later varieties, when planted in June, are surprising, as it is usually believed that the very early varieties (like "Florence") are most suited for late planting. The season was, however, abnormal, with very good and unusual late rains, which fell after the middle of October. By this time the very early variety was advanced too far to benefit, whereas apparently the other varieties had not.

Whilst the results of the one year's trial are interesting, the period of the trial is too short for them to be regarded as conclusive, especially as the season was not a normal one.

WHEAT EXPERIMENTS AT THE MERREDIN EXPERIMENT FARM.

J. H. LANGFIELD, Manager.

WHEAT VARIETY TRIAL.

In continuation of the experiment carried out last year sixteen varieties with Gluyas Early as a control were tried this season and were planted in each section in the same order as shown in the tables of results herewith. Each section was repeated eight times. Three of the sections were harvested for hay, and five for grain. The total number of plots in the experiment was 168, covering an area of 21 acres.

The land was ploughed in June, and was cultivated with the "Springtyne" in September, 1923, with the Disc implement in March, 1924, and harrowed early in April after good rains. This was to encourage the weeds to germinate and also to conserve moisture. Later it was again cultivated twice, just before seeding, and harrowed after the drilling. The seed of the different varieties was planted at the rate of 45 lbs. per acre during the third week in May, and superphosphate applied at the rate of 84 lbs. per acre.

The germination was good, and all plots showed splendid growth throughout. Owing to the dry period experienced in September blighted ears were plentiful in places, sections 3 and 4 being affected the most.

The results obtained are given in tables I. and II. herewith, and these also include the percentage yield of those varieties tried last year.

TABLE I.

WHEAT VARIETY TRIALS—MERREDIN EXPERIMENT FARM—1924.

Planted, May 24. Seed, 45lbs. Superphosphate, 84lbs.

HAY YIELDS.

Variety.	Computed Yield per Acre.									Average, 1924.			Percentage, 1924.	Percentage, 1923.
	Section 1.			Section 2.			Section 3.							
	cwt.	qr.	lbs.	cwt.	qr.	lbs.	cwt.	qr.	lbs.	cwt.	qr.	lbs.		
Gluyas Early ...	52	0	16	46	1	4	42	3	20	47	0	16	100	100
Yandilla King ...	50	3	12	45	1	20	36	2	0	44	1	4	94	...
Gluyas Late ...	50	0	16	44	2	0	43	2	24	46	0	16	98	97
Wannon	47	2	24	41	1	20	38	1	12	42	2	0	90	...
Federation	51	2	24	43	1	4	42	2	16	45	3	12	97	89
Gluyas Early ...	51	1	4	42	1	20	48	3	12	47	2	0	100	100
Hard Federation ...	49	2	0	42	1	20	42	0	0	44	2	16	94	91
Gallipoli 58/1 ...	44	0	8	36	2	24	34	3	4	38	2	0	81	...
Nabawa	44	3	4	39	1	12	37	0	8	40	1	20	85	84
Gresley	52	0	0	43	0	16	38	3	4	44	2	16	94	103
Gluyas Early ...	54	0	0	46	0	8	41	2	0	47	0	24	100	100
Nungarin	48	1	12	42	1	12	35	2	8	42	0	8	90	87
Nizam	39	2	8	37	1	4	30	3	4	35	3	12	77	...
Nangeenan	43	2	8	41	0	8	36	0	8	40	0	24	86	89
Belka	48	3	4	42	2	8	33	1	12	41	2	8	90	92
Gluyas Early ...	52	3	4	46	0	24	39	0	24	46	0	8	100	100
Carrabin	45	2	24	39	2	24	31	0	16	38	3	12	85	94
Canberra	54	1	4	46	1	20	39	0	8	46	2	8	102	106
Merredin	43	2	8	43	0	8	36	3	4	41	0	16	90	90
Florence	44	0	16	41	0	16	35	0	8	40	0	16	88	96
Gluyas Early ...	50	3	4	44	1	20	41	0	8	45	1	20	100	100

TABLE II.

WHEAT VARIETY TRIALS—MERREDIN EXPERIMENT FARM—SEASON 1924.

Planted, May 24. Seed 45lbs. Superphosphate 84lbs.

GRAIN YIELDS.

Variety.	Computed Yield per Acre.										Average. 1924.		Percentage. 1924.	Percentage. 1923.
	Sect. 1.		Sect. 2.		Sect. 3.		Sect. 4.		Sect. 5.					
	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.		
Gluyas Early ...	32	8	34	40	31	44	23	44	27	20	29	55	100	100
Yandilla King ...	36	8	37	12	31	20	22	8	24	32	30	16	103	...
Gluyas Late ...	29	4	29	20	26	40	23	4	23	52	26	24	92	104
Wannon	28	16	29	44	24	32	15	28	18	32	23	20	83	...
Federation ...	32	40	35	12	29	28	22	16	25	12	28	56	105	95
Gluyas Early ...	28	0	27	44	26	24	22	56	28	48	26	46	100	100
Hard Federation ...	28	56	27	44	24	32	13	36	25	4	24	0	92	86
Gallipoli 58/1 ...	30	16	31	12	27	12	15	4	26	16	26	0	102	...
Nabawa	30	40	29	36	24	0	17	44	27	28	25	52	104	106
Gresley	27	52	26	56	21	12	15	44	27	12	23	44	98	90
Gluyas Early ...	21	52	25	44	21	52	20	16	27	44	23	30	100	100
Nungarin	29	36	31	12	23	52	19	36	29	28	26	48	112	82
Nizam	26	48	15	44	20	56	15	12	26	56	21	4	86	...
Nangeenan ...	27	12	28	0	17	52	15	44	27	28	23	12	93	88
Belka	24	0	24	16	14	40	14	0	25	44	20	32	81	82
Gluyas Early ...	29	12	27	4	21	20	24	48	27	20	25	57	100	100
Carrabin	29	36	29	36	20	24	22	8	26	48	25	44	97	91
Canberra	32	32	30	40	23	20	25	36	32	40	28	56	108	103
Merredin	33	4	27	44	20	16	19	4	28	32	25	44	95	103
Florence	26	56	22	32	15	36	14	40	23	44	20	40	75	73
Gluyas Early ...	33	28	29	12	22	56	24	48	29	12	27	36	100	...

From the tables herewith a comparison can be made of the relative productive merits of the different varieties for hay and grain during the two seasons 1923 and 1924. It must be remembered that the season just ended was an abnormal one, with good rains after the middle of October, thus tending to suit the late maturing varieties. The previous season was one of plentiful rainfall which was light during the ripening period.

From an examination of the yields obtained it will be apparent that sections 3 and 4 are consistently lower in yield than those of the remaining sections, this lowering of the yield being due to a difference in soil type, which, on the affected section, was of a light fluffy character. It is of interest to note that the variety affected least by these conditions was Gluyas Early, and it would thus appear to be a useful variety on soils of this nature.

EARLY *v.* LATE PLOUGHING FOR FALLOWING.

During the past season an experiment was commenced to determine the effect of early and late fallow ploughing upon the yield. Two half-acre plots contiguous to each other were ploughed 4 inches deep with the Disc plough; the first on May 28th, and the other on August 26th, 1924.

On the first plot the land was in good condition for ploughing and was easily brought to a good tilth. The soil on the plot ploughed later was then rather hard and was difficult to plough to an even depth, and broke into fairly large lumps. After ploughing, both plots received the same cultivation, viz., were cultivated with "Springtyne," etc.

At the time of planting the first plot was in good order, but the second was cloddy. The variety of wheat used was "Nabawa," which was planted on the 16th May, with seed at the rate of 45 lbs. and superphosphate (22 per cent.) 84 lbs. per acre.

The yields obtained are as hereunder:—

MERREDIN EXPERIMENT FARM.

EARLY AND LATE PLOUGHING EXPERIMENT—1924.

Variety "Nabawa." Planted 16-4-24. Seed 45lbs. Superphosphate 84lbs.

Plot.	Date of Ploughing.	Grain.			Hay.			
		Computed Yield per acre.		Percentage.	Computed Yield per acre.			Percentage.
		bus.	lbs.		cwt.	qrs.	lbs.	
1	28th May, 1923 ...	30	48	100	45	1	12	100
2	26th Aug., 1923 ...	27	52	89	40	3	12	90

The results of both hay and grain are decidedly in favour of early ploughing, but apart from the increased yield obtained because of it, it becomes imperative to plough as early as possible, for the land often becomes so hard during August and September that ploughing cannot be done thoroughly.

Late Fallow. Ploughed August 26, 1924.

DEPTH OF PLOUGHING EXPERIMENT.

As in previous years, three plots were used for this experiment, being ploughed 4in., 6in., and 8in. deep respectively. They were ploughed in June, and cultivated in September. No further attention was given them until March; they were then worked with a Disc implement, harrowed after early April rains, and cultivated with the "Springtyne" twice before seeding.

The variety used was "Nabawa" and was sown on at the rate of 45 lbs. per acre, and at the same time superphosphate (22 per cent.) at the rate of 84 lbs. per acre was applied.

Early Fallow. Ploughed May 28, 1924.

This experiment has been conducted continuously since 1915. The results for this year and for the duration of the experiment are as hereunder:—

MERREDIN EXPERIMENT FARM.

Depth of Ploughing Experiment—1924.

Variety "Nabawa." Planted 16-4-24. Seed 45lbs. Superphosphate (22%), 84lbs.

Hay Yields.

No. of Plot.	Depth of Ploughing.	Computed Yield per Acre. 1924.			Computed Yield per Acre. Average, 1915-24			Percentage. 1924.	Average Percentage, 1915-1924.
		cwt.	qrs.	lbs.	cwt.	qrs.	lbs.		
1	4 inches ...	49	2	8	50	0	16	93	104
2	6 inches ...	53	2	0	48	0	8	100	100
3	8 inches ...	49	2	8	49	3	4	93	104

Grain Yields.

No. of Plot.	Depth of Ploughing.	Computed Yield per Acre. 1924.		Computed Yield per Acre. Average, 1915-24		Percentage. 1924.	Average Percentage, 1915–1924.
		bush.	lbs.	bush.	lbs.		
1	4 inches ...	32	29	24	26	101	102
2	6 inches ...	32	13	23	52	100	100
3	8 inches ...	30	13	23	10	94	97

SEASONABLE PLANTING EXPERIMENT.

For a number of years this experiment has been conducted in the test rows, but owing to the fact that the same conditions under which it was grown did not obtain under crop conditions, it was decided to carry out this trial as a field experiment.

Five varieties were used, viz., "Yandilla King," a recognised late variety; "Nabawa," a midseason; "Gluyas Early" and "Merredin," early; and "Florence," very early variety. These varieties were planted adjacent to each other in sections with "Gluyas Early" as a control, beginning and ending the section. Each section was repeated three times.

Three plantings were made, the first on the 8th April, the second the middle of May, and the last on the 16th June. "Yandilla King" was not included with the others in the April planting, as at that time the seed, which was being obtained from the Chapman Farm, had not come to hand. Control plots of "Gluyas Early" planted on May 23rd were used throughout the three plantings.

A Section of the Seasonable Planting Experiment. Merredin, 1924.

In all cases the rate of seed was 45 lbs. per acre, and that of superphosphate (22 per cent.) 84 lbs. per acre.

When the early planting was made the land was in fair condition, but there was not sufficient moisture to germinate all the seed; about half of it came up directly after planting, but the balance did not germinate until the 20th May. The April planting was thus very largely in effect equivalent to May planting. That which germinated first came into ear very early, especially the "Florence," some ears of this variety being clear of the sheath on

the 4th July, whilst ears of the "Gluyas Early" and "Merredin" were clear on the 20th August. The earliest three varieties suffered from blighted ears, "Florence" being much the worst.

The results obtained from the April and June plantings are shown in the table hereunder:—

MERREDIN EXPERIMENT FARM.

SEASONABLE PLANTING EXPERIMENT.

Date of Planting.	Variety.	Computed Yield per Acre.						Average Yield.		Percentage Yield.
		Section 1.		Section 2.		Section 3.				
		bush.	lbs.	bush.	lbs.	bush.	lbs.	bush.	lbs.	
May 23rd ...	Gluyas Early ...	30	24	27	52	30	32	29	36	100
April 8th	Nabawa	33	52	31	12	32	48	32	40	109
	Gluyas Early ...	24	32	25	20	24	40	24	48	82
	Merredin	23	12	27	52	25	4	25	20	83
	Florence	19	28	21	36	15	4	18	40	60
May 23rd ...	Gluyas Early ...	32	32	29	44	31	52	31	20	100
May 23rd ...	Gluyas Early ...	20	0	20	32	23	20	21	20	100
June 16th	Yandilla King ...	20	48	20	48	22	24	21	20	101
	Nabawa	21	52	21	44	24	24	22	40	107
	Gluyas Early ...	21	44	19	52	22	40	21	28	102
	Merredin	19	28	17	12	20	8	18	56	90
	Florence	12	40	9	44	11	12	11	12	54
May 23rd ...	Gluyas Early ...	19	36	19	36	23	12	20	48	100

The yields obtained from the varieties planted in May may be had from the results of the main Variety trial.

For comparative purposes the percentage yields abstracted from the tables of these results, together with the percentage results from the April and June plantings, are shown below:—

MERREDIN EXPERIMENT FARM.

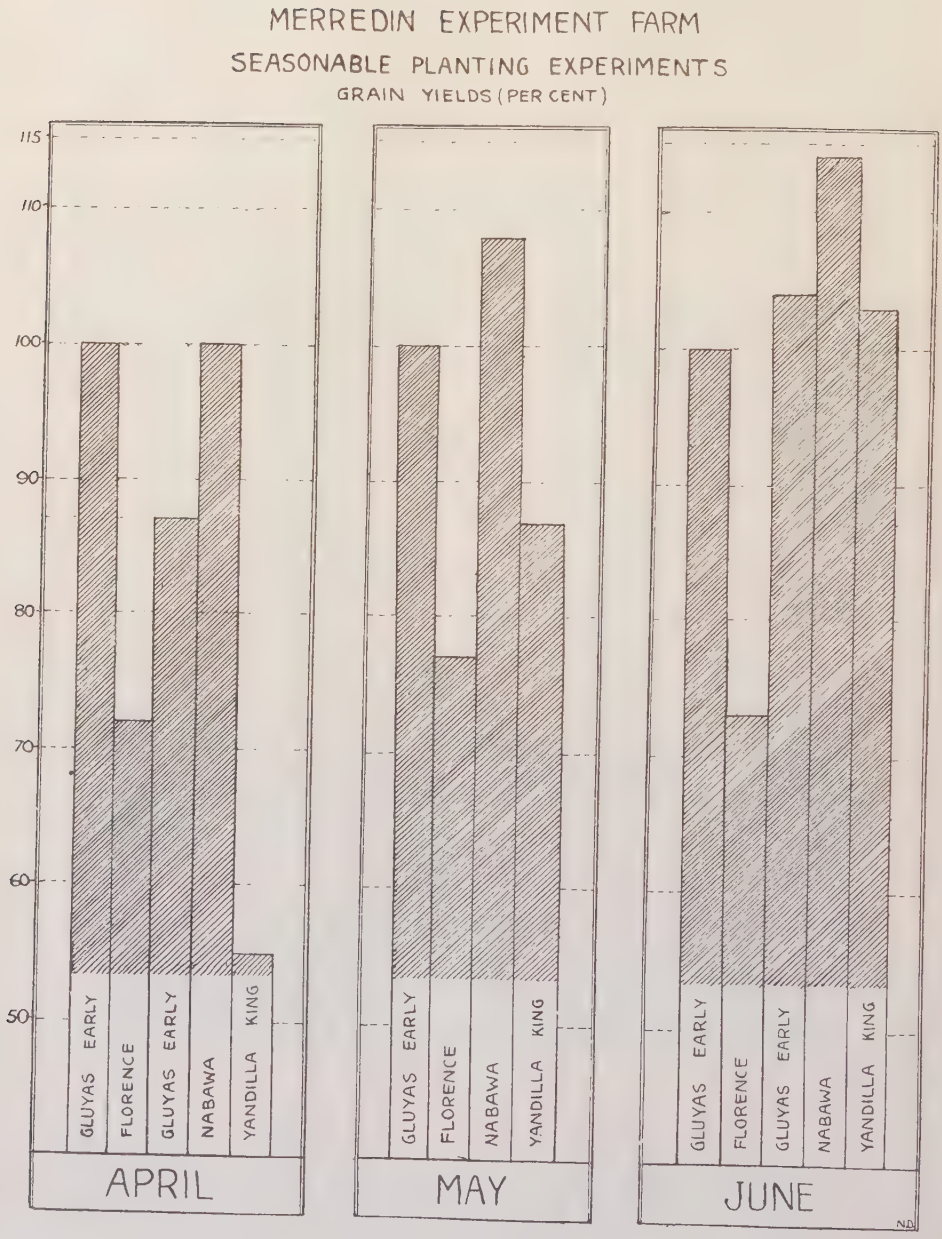
SEASONABLE PLANTING EXPERIMENT.

Percentage Results.

GRAIN YIELDS.

	April	May.	June.
Yandilla King	...	103	101
Nabawa	109	104	107
Gluyas Early	82	100	102
Merredin	83	95	90
Florence	60	75	54

It will be noted that the very early variety, "Florence," planted in June, has not yielded nearly as well as the later maturing varieties. This is contrary to expectations and may be due to the peculiarity of the season, as unusually good late rains were experienced during the third week in October, by which time "Florence" was practically matured, whilst the other varieties were in a condition to respond to the rain. This point will be watched with interest as the experiment proceeds.


MERREDIN EXPERIMENT FARM
SEASONABLE PLANTING EXPERIMENTS
GRAIN YIELDS (PER CENT)
115
110
100
90
80
70
60
50
GLUYAS EARLY
FLORENCE
GLUYAS EARLY
NABAWA
YANDILLA KING
APRIL
GLUYAS EARLY
FLORENCE
NABAWA
YANDILLA KING
MAY
GLUYAS EARLY
FLORENCE
GLUYAS EARLY
NABAWA
YANDILLA KING
JUNE
N.D.

METEOROLOGICAL INFORMATION.

1925.

STATIONS.	TEMPERATURE.				RAINFALL.		TEMPERATURE.				RAINFALL.		TEMPERATURE.				RAINFALL.	
	Maximum.		Minimum.		For Month.	Average.	Maximum.		Minimum.		For Month.	Average.	Maximum.		Minimum.		For Month.	Average.
	Mean.	Highest.	Mean.	Lowest.			Mean.	Highest.	Mean.	Lowest.			Mean.	Highest.	Mean.	Lowest.		
	MARCH, 1925.						APRIL, 1925.						MAY, 1925.					
					points.	points.					points.	points.					points.	points.
Chapman Experiment Farm	88·0	100·6	64·6	55·9	102	46	82·4	96·8	56·0	45·2	2	40	72·2	86·5	51·5	42·2	250	224
Geraldton	84·1	98·3	67·6	57·4	101	39	78·3	87·5	59·5	47·8	[illegible]	84	73·1	81·2	57·0	43·1	205	282
Walebing	85·4	99·5	58·4	43·0	89	71	78·9	98·0	53·8	42·5	9	78	...	...	...	...	...	249
Perth	80·1	94·1	62·4	55·3	119	76	75·2	87·9	56·6	44·0	49	159	69·0	81·2	53·2	42·9	497	495
Kalamunda	79·0	91·0	62·7	53·7	64	80	74·2	88·5	54·8	43·9	20	159	...	...	52·6	40·4	671	591
Bunbury	78·9	90·8	...	...	...	101	75·4	86·8	53·0	42·2	83	167	67·7	77·4	50·8	39·8	332	534
Bridgetown	78·3	95·0	52·3	37·2	98	101	73·7	88·0	45·1	30·0	52	161	65·0	77·2	43·6	34·0	442	458
Albany	72·2	85·0	58·9	50·0	140	151	67·8	77·0	55·9	50·0	384	266	65·0	73·0	52·0	47·0	604	508
Merredin Experiment Farm	82·1	97·0	61·3	48·6	43	86	77·2	94·9	51·7	37·8	27	85	66·6	79·1	47·7	35·0	104	135
Northam	82·5	97·5	60·4	52·5	288	62	78·4	97·9	48·6	40·0	22	80	70·0	83·5	46·9	35·5	171	223
York	82·1	97·0	59·3	49·0	121	56	78·1	96·1	51·0	39·2	10	84	69·6	83·0	47·1	34·0	175	235
Narrogin School of Agriculture	77·9	92·5	55·9	42·3	73	64	73·2	92·0	50·0	36·8	39	116	64·9	73·7	46·9	35·3	203	286
Katanning	75·7	89·2	55·7	42·8	218	91	71·6	90·0	49·4	37·4	94	115	...	...	...	...	...	235
Cape Leeuwin ...	72·3	89·8	62·1	57·2	77	123	68·5	78·8	59·3	52·0	369	197	...	...	...	...	..	568

MARKET REPORT.

Chaff.—The following particulars of the approximate quantities of both wheaten and oaten chaff available for auction at the Metropolitan Chaff and Grain Auction Sales, held in Perth during the months of March, April, and May; also the minimum and maximum prices ruling for f.a.q. to prime quality wheaten chaff during those months have been kindly supplied by Messrs. H. J. Wigmore & Co., Perth:—

March.—Quantity, 2,750 tons.
Minimum price for f.a.q. to prime—£6 15s. per ton.
Maximum price for f.a.q. to prime—£7 per ton.

April.—Quantity—2,700 tons.
Minimum price for f.a.q. to prime—£6 12s. 6d. per ton.
Maximum price for f.a.q. to prime—£7 per ton.

May.—Quantity—3,100 tons.
Minimum price for f.a.q. to prime—£6 5s. per ton.
Maximum price for f.a.q. to prime—£7 per ton.

Wheaten Chaff.—If our last report in this *Journal* is referred to it will be seen that supplies have been heavier during the last three months than the three months preceding; in December 2,450 tons reaching the market, January 1,900 tons, and February 2,400 tons, and this can be accounted for by the truck difficulty being overcome. It will be noticed that in March and April the market fluctuations were small, and right up to the middle of May f.a.q. to prime was selling at up to £6 17s. 6d. per ton. However, immediately rain fell the market weakened, and receded day by day until at the end of May the top price obtainable was £6 5s. per ton. At time of going to press (3rd June) the market is rather weak at £6 5s., but, of course, should we experience a dry spell a firmer tone will be noticeable. From information gathered from the various hay districts there does not appear to be a superabundance of hay, and from a seller's standpoint the position cannot be called an unsatisfactory one.

Oaten Chaff.—In March and April heavy supplies were arriving, and with a poor demand the market was exceedingly dull, f.a.q. selling at around £5 per ton, good mediums £4 15s., and mediums £4 7s. 6d. to £4 10s. However, no doubt owing to farmers being too busy seeding to load chaff, supplies dwindled, and at time of writing there is an excellent demand for f.a.q. at around £5 10s., good mediums at £5 5s., and mediums suitable for cow feed at £4 15s. to £5 per ton.

Oats.—We believe that holdings in the country are fairly heavy, and now that good rains have fallen adequate supplies will no doubt be continually arriving. The demand is not large, and the market is rather dull at around 2s. 8d. per bushel for good heavy feeds, and from present indications there appears to be little likelihood of any improvement for some time.

Wheat.—During the last day or two the market has firmed, and f.a.q. is selling under the hammer at from 6s. 2d. to 6s. 4d. per bushel.

LIVE STOCK AND MEAT.

For the information of readers of the "Journal," the following particulars have been supplied by Messrs. Elder, Smith, & Co., Limited, Perth:—

COMPARATIVE YARDINGS OF STOCK AT METROPOLITAN FAT STOCK MARKETS, DURING MONTHS OF MARCH, APRIL, AND MAY, 1925.

	MARCH.				APRIL.					MAY.			
	4.	11.	18.	25.	1.	8.	15.	22.	29.	6.	13.	20.	27.
Sheep and Lambs	7,090	9,596	7,092	6,287	6,923	8,394	6,698	6,090	6,010	6,956	4,738	6,344	5,426
Cattle ...	544	658	145	345	504	175	680	28	610	706	556	734	560
Pigs ...	855	978	809	445	958	944	659	819	530	698	786	407	693

COMPARATIVE VALUES OF STOCK SOLD AT METROPOLITAN FAT STOCK MARKETS, DURING MONTHS OF MARCH, APRIL, AND MAY, 1925.

	MARCH.				APRIL.					MAY.			
	4.	11.	18.	25.	1.	8.	15.	22.	29.	6.	13.	20.	27.
Mutton	11	11	11¼	11¼	11¼	11¼	11	11½	11½	11¼	11¼	10¾	11¼
Beef ...	8	8	8¼	9½	9½	9½	7¾	7¼	7½	7½	8	8	8
Pork ...	11¾	11¼	11¼	12	12	12	11½	11	11¼	11¼	11¼	12	12
Bacon ...	10	10	10	10	10	10	10	10	10	10	10½	9¾	9½

WESTERN AUSTRALIA—DEPARTMENT OF AGRICULTURE.

List of Bulletins available for Distribution.

No. 20.—*The Pruning of Fruit Trees.* By J. F. Moody. Price 2s. 6d
No. 46—*Fruit Packing and Marketing and Exporting of Fruit.* By J. F. Moody and J. Ramage. Price 1s. 6d.
No. 47.—*The Poultry Keeper's Manual.* By G. Allman. Price 1s.
No. 83.—*Horticulture and Viticulture.* By A. Despeissis. Price 2s.
No. 5.—*Fruit Drying.* By J. F. Moody. Free.
No. 15.—*Root Rot.* By A. J. Despeissis. Free.
No. 24.—*Hints to Stock Breeders* (revised). By R. E. Weir. Free.
No. 41.—*Irrigation and Drainage.* By A. H. Scott. Free.
No. 49.—*The Feeding of Horses.* By Professor Paterson and G. L. Sutton. Free.
No. 57.—*Vermin Destruction.* By A. Crawford. Free.
No. 60.—*The Farmer's Clip.* By J. J. Mahood. Free.
No. 68.—*Flaying and Treatment of Hides.* By R. E. Weir. Free.
No. 72.—*The Potatoe: Its Cultivation, Pests and Diseases.* By G. N. Lowe, L. J. Newman, D. A. Herbert. Free.
No. 74.—*Tobacco Growing: Notes for Intending Planters.* By G. W. Wickens. Free.
No. 79.—*Sheep on the Wheat Farm and their Management in W.A.* By H. McCallum. Free.
No. 81.—*The Improvement of Pastures.* By E. A. Mann and D. A. Herbert. Free.
No. 87.—*Sheep Feeding Experiments: State Farm, Chapman,* 1920. By G. L. Sutton and F. Vanzetti. Free.
No. 88.—*Light Land: Conference.* By G. L. Sutton. Free.
No. 90.—*Stock Waters: Standard for Composition of.* By E. A. Mann. Free.
No. 93.—*The Home Tanning of Sheep and other Skins.* By H. Salt. Free.
No. 94.—*The Dingo.* By B. W. Leake. Free.
No. 95.—*The Stickfast Flea.* By L. J. Newman and Geo. Allman. Free.
No. 96.—*Poison Plants of W.A.* By D. A. Herbert. Free.
No. 99.—*Australian White.* By G. L. Sutton. Free.
No. 101.—*Cotton Cultivation.* By G. L. Sutton. Free.
No. 103.—*Kerosene Method for Eradicating Zamia Palm.* By G. K. Baron-Hay. Free.
No. 104.—*Stickfast Flea.* By J. G. C. Campbell. Free.
No. 105.—*Pedigree Selection of Seed.* By G. L Sutton. Free.
No. 106.—*The Red Legged Velvet Earth Mite.* By L. J. Newman. Free.
No. 107.—*Sudan Grass.* By G. L. Sutton. Free.
No. 108.—*Lucerne.* By G. L. Sutton. Free.
No. 109.—*Rape.* By G. L. Sutton. Free.
No. 110.—*Subterranean Clover.* By G. K. Baron-Hay. Free.
No. 111.—*Standard Wheat Varieties.* By G L. Sutton and F. Vanzetti. Free.
No. 112.—*Automatic Device for Eradication of Stickfast Flea.* By G. Allman. Free.
No. 113.—*Picked Pieces (Classification of Clip).* Free.
No. 114.—*Blue Mould on Citrus Fruits.* By W. M. Carne. Free.
No. 115.—*The Value of Windmills for pumping Water in W.A.* A. H. Scott.
No. 116.—*Spotted Wilt of Tomatoes.* W. M. Carne.
No. 117.—*Cream.* P. G. Hampshire.
No. 118.—*Pigs and Pig Raising.* P. G. Hampshire.
No. 119.—*Take-all of Wheat and Similar Diseases of Cereals.* By W. M. Carne and J. G. C. Campbell.
No. 120.—*Pastures in the South-West.* A. B. Adams. (Reprint from "Journal.")
No. 121.—*Mildew, Septoria, Leaf Spots, and Similar Diseases of Cereals.* W. M. Carne and J. G. C. Campbell.
No. 122.—*Fruit Fly. Description and Control.* L. J. Newman.
No. 123.—*The Development of a Dairy Herd.* P. G. Hampshire. (Reprint from "Journal.")
No. 124.—*Government Inspection of Wheat.* G. K. Baron-Hay. (Reprint from "Journal.")
No. 125.—*Buy Good Seed.* (Advice to Farmers.) W. M. Carne. (Reprint from "Journal.")
No. 126.—*The Rust of Cereals.* W. M. Carne and J. G. C. Campbell.
No. 127.—*Wheat Yields—Competitions.*
No. 128.—*Woolly Aphis Parasite (Aphelinus mali).* (Hald.) L. J. Newman. (Reprint from "Journal.")
No. 129.—*The Farm Horse: Hints on Feeding.* A. McK. Clark. (Reprint from "Journal.")
No. 130.—*Minerals and the Health of Cattle.* A. B. Adams. (Reprint from "Journal.")
No. 131.—*The Strength of Wheat and Flour.* R. G. Lapsley. (Reprint from "Journal.")
No. 132.—*Development of a Dairy Herd—No.* 2. P. G. Hampshire. (Reprint from "Journal.")
No. 133.—*Kikuyu Grass for Poultry.* G. L. Sutton. (Reprint from "Journal.")

No. 134.—*Flag Smut of Wheat.* W. M. Carne. (Reprint from "Journal.")
No. 135.—*The Objects of Farmers' Trials.* G. L. Sutton. (Reprint from "Journal.")
No. 136.—*The Use of the Scythe.* H. Campbell. (Reprint from "Journal.")
No. 137.—*Winter Trapping of the Fruit-fly.* L. J. Newman. (Reprint from "Journal.")
No. 138.—*Clearing Heavily-timbered Pastures.* A. B. Adams. (Reprint from "Journal.")
No. 139.—*Ants as a Domestic Pest.* J. Clark. (Reprint from "Journal.")
No. 140.—*Surface Drainage.* A. R. Clifton. (Reprint from "Journal.")
No. 141.—*Breeding a Permanent Flock.* H. McCallum. (Reprint from "Journal.")
No. 142.—*The Plague Locust.* L. J. Newman. (Reprint from "Journal.")
No. 143.—*Zamia Palm and "Rickets" in Cattle—Method of Eradication.* A. B. Adams and G. K. Baron-Hay.

The following publications may be obtained from the Department of Agriculture, Perth, on application, or will be sent post free to any address in this State on receipt of a remittance for the amounts stated:—

The Handbook of Horticulture and Viticulture of Western Australia, by A. Despeissis, M.R.A.C.:

This publication contains valuable information dealing with all commercial fruits grown in Western Australia, including advice on planting, pruning, packing, manuring, fruit-drying, wine-making, insect and fungoid pests and their treatment, etc., and the whole forms a text book which every fruitgrower, whether large or small, should have in his possession. The price originally was 8s. 6d., but to allow of distribution being as wide as possible it has been reduced to 2s.

The Pruning of Fruit Trees, by J. F. Moody, Fruit Industries Commissioner:

This publication contains numerous illustrations, being reproduction of photographs taken in this State, of pruned and unpruned trees, which make the details set out in the letterpress particularly easy to understand. Price, 2s. 6d.

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This publication contains invaluable information on packing and grading fruit for local and export markets. It is freely illustrated, and no fruit-packing shed should be without a copy. Price 1s. 6d.

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This is a most useful and valuable book, not only for beginners, but to all those who keep fowls for pleasure and profit. It deals fully with all matters connected with the industry, including Breeding, Feeding (for stock birds or egg production), Incubating, Brooding and care of chicks, Marketing (eggs and Poultry), and all matters of use to the poultry-keeper. It also fully describes symptoms of various ailments and diseases and simple treatment for same, and, as the book was written to suit *local conditions* every poultry-keeper should have a copy by him. Price, 1s.

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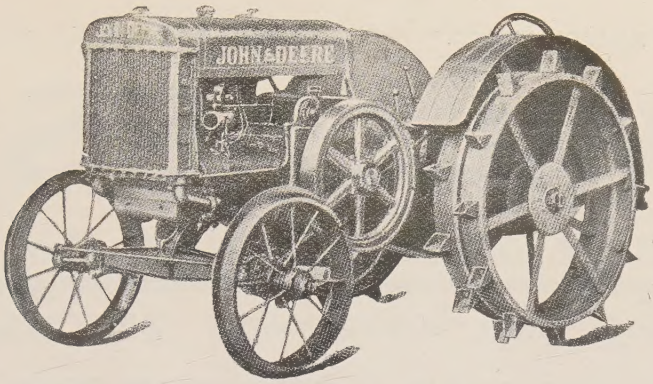

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Agricultural Bank.

ADVANCES TO FARMERS.

The Agricultural Bank, which is a State institution and is worked under a Special Act was founded with the object of making advances to settlers for the purpose of assisting and encouraging them during the early years of the development of their farm.

The Agricultural Bank makes advances on approved securities to approved persons engaged in the business of farming or grazing, or in horticultural pursuits, to an amount not exceeding £2,000.

Every application must be made on the prescribed form, and must contain full particulars of the purposes for which the advance is required.

Where an advance is approved for effecting improvements on the borrower's land, such advance is made by progress payments as the work progresses.

Developmental advances are usually made for clearing, fencing, ringbarking, and water supply, and are made to the full value of the work done after it has been inspected and certified to by a responsible officer. After a reasonable stage of development has been reached, and providing the general progress of the settler is considered satisfactory, limited assistance is granted towards building (maximum £250), and money is provided to assist in the purchase of stock and machinery, the maximum amount for this purpose, except in special cases, being £150.

Interest is charged at the rate of seven per cent. per annum, and repayment of principal extends over a period of 30 years, except in the case of stock or machinery advances which have a currency of eight years only.

The security required by the Bank is a first mortgage over the lands on which the advance is to be expended, and such lands may consist of :—

(a) Holdings in fee simple ; or
(b) Holdings under Special Occupation Lease or Conditional Purchase from the Crown ; or
(c) Homestead Farms ; or
(d) Such other real or leasehold property as the Trustees may think fit.

Mortgages are prepared free of charge ; but borrowers are required to pay the statutory costs of registration.

Interest only on the advances made is charged during the first 10 years, and repayment of the capital does not commence until the eleventh year.

Application may be for sums of £25, or any multiple thereof, not exceeding £2,000. Each application must be accompanied by a valuation fee of one per cent of the amount applied for. No refund of fee is allowed after an inspection of the security has been made.

The leases, or Occupation Certificate, as the case may be, together with the fees, must be in the possession of the Bank before a mortgage can be prepared.

REGISTRATION FEES.

	s.	d.
For each Conditional Purchase, Homestead Farm, or Grazing Lease under the Land Act	5	0
For each Freehold Lot or Crown Lease	10	0
For every additional Freehold Lot or Crown Lease	2	0

STAMP DUTY

	s.	d.		s.	d.
Up to £50	1	3	From £301 to £400	10	0
From £51 to £100	2	6	„ £400 „ £500	12	6
„ £101 „ £150	3	9	Stock Bill of Sale, up to £50	5	0
„ £151 „ £200	5	0	„ „ over £50	10	0
„ £201 „ £250	6	3	Machinery Bill of Sale, up to £50	5	0
„ £251 „ £300	7	6	„ „ „ over £50	10	0

Intending borrowers are requested to note that no advances are made against improvements effected prior to date of application. Applications should, in every instance, be lodged prior to commencement of work, and moneys are then paid over in progress payments as the work proceeds.

IMPROVED FARMS.

The Trustees of the Agricultural Bank have, from time to time, improved farms on their hands which have been abandoned for various causes, or have been taken over as security for loans. These farms are available for purchase, and extended terms are given for payment of the amount. They often offer to intending settlers an opportunity of obtaining an improved holding, ready for occupation, at a cheap rate, without having to undertake the preliminary work of clearing and fencing. The properties, when obtainable, are advertised in the "Government Gazette" ; but anyone wishing for particulars of such farms as may be available should make application to the Managing Trustee of the Agricultural Bank. Particulars will then be sent, and an inspection can be made by the intending settler to ascertain whether the same is suitable for his requirements.

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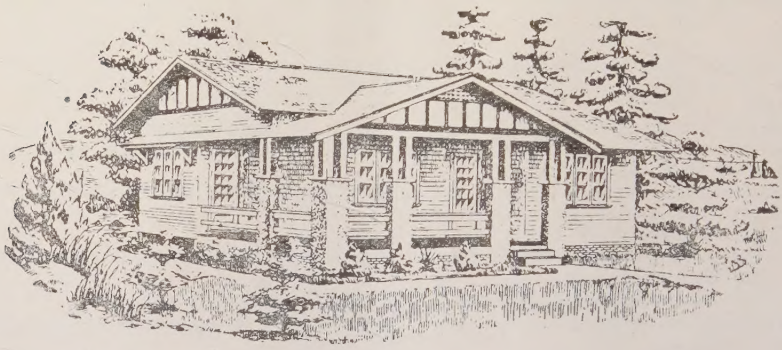

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